

# STORMWATER MANAGEMENT MANUAL

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# Chapter 1.0

## STORMWATER MANAGEMENT IN EUGENE

This chapter outlines the City of Eugene’s stormwater management requirements.

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## **1.1 INTRODUCTION**

Pursuant to Eugene Code 9.6790, this Stormwater Management Manual was developed in order to implement the Stormwater Development Standards as outlined in Eugene Code 9.6791 through 9.6797.

Stormwater management is a key element in maintaining and enhancing the City's livability. There is a direct link between stormwater runoff and the City's surface and ground water quality and quantity. As cities develop, impervious surfaces that are created increase the amount of runoff during rainfall events and prevent groundwater recharge. Stormwater runoff picks up pollutants from parking lots, roadways, and rooftops and transports them to streams, rivers, and groundwater. Without controls, these conditions cause eroded stream channels and increased levels of water pollution. Properly managing stormwater is vital to protecting our water resources for a great number of uses, including fish and wildlife habitat, recreation, and drinking water.

The Federal Clean Water Act of 1972 established a national commitment to restore and maintain the chemical, physical, and biological integrity of the nation's waters. It prohibits the discharge of pollutants into water of the United States unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) Permit. The Clean Water Act requires large and medium sized (Phase I) cities such as Eugene to obtain an NPDES permit for their municipal separate stormwater sewer systems (MS4) which discharge into the nation's waters. Eugene's municipal stormwater system, comprised of catch basins, pipes, ditches and waterways, conveys runoff from properties within the City and drains directly into the Willamette River and indirectly to the river via other local waterways such as Amazon Creek. Compliance with its NPDES MS4 permit, first issued in 1994 and most recently re-issued in 2010, requires the City to implement a comprehensive stormwater management program including establishing controls on stormwater runoff from developing areas.

The City's Stormwater Development Standards, as set forth in Eugene Code 9.6791 through 9.6797 and this Stormwater Management Manual, emphasize low-impact development practices, source control measures for certain land use and activities, and operations and maintenance practices designed to properly manage stormwater runoff and protect our water resources.

## 1.2 PURPOSE OF THE MANUAL

The purpose of this manual is to set forth requirements consistent with EC 9.6790 and 7.143 (2) providing stormwater management principles and techniques that help preserve or mimic the natural hydrologic cycle and achieve water quality goals. The manual:

- Provides developers and design professionals with facility design requirements for reducing the impacts of stormwater runoff quantity and pollution resulting from new development.
- Is applicable to development that is subject to the adopted stormwater development standards (see **Appendix A**).
- Is applicable to stormwater facilities constructed in the public rights of way (see **Appendix A**).

These standards are not intended to limit innovation or creativity, particularly when such efforts result in higher quality and/or lower costs. Deviations from these standards shall be determined in accordance with the City's adjustment review process.

## 1.3 SUMMARY OF MANUAL CONTENTS

**Chapter 1.0: Stormwater Management in Eugene** outlines the purpose and use of this manual, defines terms, and the stormwater quality, flow control, and flood control design standards pertinent to Eugene.

**Chapter 2.0: Selecting, Designing, Constructing and Landscaping Stormwater Management Facilities** provides methods for selecting and designing stormwater management facilities that accomplish stormwater quality, flow control, and/or flood control goals.

**Chapter 3.0: Source Controls** addresses site activities and characteristics with the potential to generate pollutants that may not be addressed solely through the stormwater quality facilities presented in Chapter 2.0.

**Chapter 4.0: Operating & Maintaining Stormwater Facilities** includes operations and maintenance (O&M) submittal forms and templates for stormwater management facility O&M plans.

**Appendix A: Eugene Code (EC) - Stormwater Development Standards (EC Section 9.6790-9.6797), Stormwater Facility Operation and Maintenance (EC 6.615), Public Improvement Construction - Wastewater Sewer Systems and Stormwater Management Facilities (EC 7.143)** includes Eugene Code sections that regulate stormwater management policies and standards, and that authorizes the City's *Stormwater Management Manual* and stormwater management enforcement authority and requirements.

**Appendix B: Typical Facility Details** presents typical cross sectional detail for stormwater management facilities.

**Appendix C: Forms** includes SIM Form, DAR Form, Notice of O & M and O & M forms for recording purposes.

**Appendix D: Facility Planting Design** presents plant species recommendations for vegetated stormwater facilities.

**Appendix E: Approved Proprietary Stormwater Treatment Technologies** lists all proprietary stormwater treatment technologies approved for use to meet Eugene's stormwater quality requirements.

**Appendix F: Flow Control Structure and Pipe Outfall Sizing** present guidance and requirements for the design of flow control structures and pipe outfalls.

**Appendix G: Infiltration Testing** procedures for Simplified and Presumptive methods.

**Appendix H: Stormwater Analysis Reports** present content and format requirements for preparation of engineering stormwater reports.

**Appendix I: Infiltration Limited Areas Map and NRCS Soil Group Map** presents areas which may be infiltration limited due to generalized site conditions such as soil type and groundwater depth.

**Appendix J: Headwater Streams Map** presents headwater streams identified for flow controls.

**Appendix K: Flood Control Design Storm Tables** outlines the rainfall intensity, duration and frequency curves, storm recurrence intervals, and storm events for planning and designing stormwater flood control facilities.

**Appendix L: Water Quality Design Storm Development** outlines the rationale behind the development of Eugene's stormwater quality storm events.

**Appendix M: Santa Barbara Urban Hydrograph Method** describes the Santa Barbara Urban Hydrograph method and includes the City's 24-hour rainfall depths, formulas for computing time of concentration, and runoff curve numbers.

## 1.4 DEFINITIONS

**Note:** Definitions are intended to be consistent with Eugene Code Chapter 9, Land Use; Chapter 6, Environment and Health; and Chapter 7, Public Improvements.

***Above-Ground Storage Tank (AST):*** A stationary container, vessel, or other permanent holding device designated for the storage and/or distribution of a liquid product.

***Applicant:*** Any person, company, or agency that applies for a permit through the City of Eugene.

***Batch Discharge:*** The controlled discharge of a discrete, contained volume of water or wastewater. Batch discharges into the public wastewater system must conform to the requirements of Eugene Code sections 6.501-6.596, Industrial Pretreatment Program.

***Bulk Fuel Terminal:*** Any area with its primary function dedicated to the storage and distribution of fuel to distributors (such as gas stations).

***Bulk Materials:*** Product, by-product, and waste materials that aren't stored or completely held within a discrete area or container.

***Capacity:*** The capacity of a stormwater drainage system is the flow volume or rate that a facility (*e.g.*, pipe, pond, vault, swale, ditch, drywell, etc.) is designed to safely contain, receive, convey, reduce pollutants from or infiltrate stormwater that meets a specific performance standard. There are different performance standards for stormwater quality, detention, conveyance, and flood control, depending on location.

***Containment:*** The temporary storage of potentially contaminated stormwater or process wastewater when a hard-plumbed connection to the City wastewater system is not available for disposal.

***Control Structure:*** A device used to hold back or direct a calculated amount of stormwater to or from a stormwater management facility. Typical control structures include vaults or manholes fitted with baffles, weirs, or orifices.

***Conveyance:*** The transport of stormwater from one point to another.

***Destination:*** The ultimate discharge point for the stormwater runoff from a particular site. Destination can include on-site infiltration such as surface infiltration facilities, drywells and sumps, and soakage trenches, and off-site flow to ditches, drainage ways, rivers and streams, and off-site storm pipes.

***Detention Facility:*** A facility designed to receive and hold stormwater and release it at a slower rate, usually over a number of hours. The full volume of stormwater that enters the facility is eventually released.

**Development Footprint:** The new or redeveloped area covered by buildings or other roof structures and other impervious surface areas, such as roads, parking lots, and sidewalks.

**Discharge Point:** The ultimate destination for the stormwater runoff from a particular site. Destination can include on-site infiltration such as surface infiltration facilities, drywells and sumps, and soakage trenches, and off-site flow to ditches, drainage ways, rivers and streams, and off-site storm pipes.

**Drainage Basin:** A specific area that contributes stormwater runoff to a particular point of interest, such as a stormwater management facility, stream, wetland, or pipe.

**Drawdown Time:** The amount of time it takes for a facility to percolate runoff from the design storm.

**Filtration:** The percolation of water through designed soils or media with the use of under drains to convey treated runoff from the development site to approved discharge points.

**Flood Control:** The practice of managing stormwater drainage and flood protection. Drainage and flood protection strategies are outlined in the adopted City of Eugene Stormwater Basin Master Plans.

**Flood Control Design Storm:** A theoretical storm for evaluating the capacity of the storm drainage system and designing improvements for the required level of protection.

**Flow Control:** The practice of limiting the peak flow rates and volumes. Flow control is intended to protect downstream properties, infrastructure, and resources from the increased stormwater runoff peak flow rates and volumes resulting from development.

**Flow Control Facility:** Any structure or drainage device that is designed, constructed, and maintained to collect, retain, infiltrate, or detain surface water runoff during and after a storm event for the purpose of controlling post-development water quantity leaving the development site.

**Flow-Rate-Based Facility:** Facilities such as swales and vegetated filters, oil/water separators, and some proprietary treatment systems which are sized to treat a rate of flow to be conveyed through them.

**Green Infrastructure:** A comprehensive approach to water quality protection defined by a range of natural and built systems and practices that use or mimic natural hydrologic processes to infiltrate, evapotranspire, or reuse stormwater runoff on the site where it is generated.

**Hazardous Material:** Any material or combination of materials that, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or that may pose a present or potential hazard to either human health, safety, or welfare, or animal or aquatic life or the environment when

improperly used, stored, transported or disposed of, or otherwise managed. For purposes of chemical regulation by this manual, moderate to high toxicity and confirmed human carcinogenicity are the criteria used to identify hazardous substances. (Note: This manual does not use the Resource Conservation and Recovery Act (RCRA) definition of hazardous. For the purpose of this manual, hazardous material is intended to include hazardous, toxic, and other harmful substances.)

**Hazardous Material Containment Zone (HMC Zone):** An area where a specific individual activity involving use of a hazardous material takes place, and where chemical quantities at that location are expected to exceed defined thresholds. HMCs may include (but are not limited to) storage and/or process areas, transportation routes, work areas, and loading/unloading facilities.

**Headwaters Area:** The area within Eugene city limits that is above 500 feet.

**Headwater Streams:** Streams that: (1) are identified on the Headwater Streams Map (**Appendix J**) as having all or a portion of their length located on slopes greater than 10%; (2) are identified on the Sensitive Areas Map as having all or a portion of their length located in areas with highly erodible soils; (3) are at least 500 feet or longer; and, (4) drain at least 10 acres.

**High-Flow Bypass and/or Diversion Device:** A mechanism used to route stormwater runoffs which are greater than the water quality design storm around a stormwater management facility which is only designed to treat the water quality design storm. Flows routed around the stormwater quality facility must be taken to an approved destination.

**High-Flow Overflow:** An inlet located at an approved elevation and location within a stormwater management facility, meant to collect overflow waters and route those waters to an approved destination.

**High-Risk Site:** A site with characteristics and/or activities that have the potential to generate pollutants that may not be addressed solely through the stormwater quality facilities presented in Chapter 2.0. High-risk site characteristics and activities are listed in Chapter 4 – Source Controls.

**Impervious Surface/Area:** Any surface area that causes water to run off the surface in greater quantities or at an increased rate of flow from conditions pre-existing to development. Types of impervious surface include, but are not limited to, rooftops, asphalt and concrete parking lots, driveways, roads, sidewalks, and pedestrian plazas. *Note:* Slatted decks are considered pervious. Gravel surfaces are considered pervious unless they cover impervious surfaces or are compacted to a degree that causes their runoff coefficient to exceed 0.8.

**Impervious Area Reduction Technique:** Implementation of a facility used to intercept rainfall that would otherwise be impervious, such as a roof or sidewalk. Such facilities include pervious pavement, eco-roofs, contained planters, and tree credit trees.

***Infiltration:*** The percolation of water into the ground.

***Inlet:*** A structural facility located just below the ground surface, used to collect stormwater runoff for conveyance purposes. Generally located in streets and parking lots, inlets have grated lids, allowing stormwater from the surface to pass through for collection. The term “inlet” can also be used in reference to the point at which stormwater from impervious surfaces or conveyance pipe enters a stormwater management facility.

***LD-50:*** The lethal dose of a substance that is expected to kill approximately 50 percent of experimental animals through oral ingestion. (Refer to product Material Safety Data Sheet.)

***Local Dispensing Location:*** An area within 15 feet of an above-ground storage tank (AST) and used to dispense fuel directly from the AST, typically through a flexible hose.

***Low Impact Development (LID):*** A stormwater management approach that seeks to mitigate the impacts of increased runoff and stormwater pollution using a set of planning, design, and construction approaches and stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater, and can occur at a wide range of landscape scales (i.e., regional, community, and site scales).

***Mechanical Treatment Facilities:*** Manufactured and proprietary stormwater quality devices used to remove pollutants from stormwater.

***Notice of Operations and Maintenance:*** A recorded document that identifies the presence of a privately maintained stormwater management facility.

***Off-Site Stormwater Facility:*** Any stormwater management facility located outside the property boundaries of a specific development, but designed to reduce pollutants from and/or control stormwater flows from that development.

***On-Site Stormwater Facility:*** Any stormwater management facility necessary to control stormwater within an individual development site and located within the boundaries of the development site.

***Operations and Maintenance (O&M):*** The continuing activities required to keep stormwater management facilities and their components functioning in accordance with design objectives.

***Operations and Maintenance Plan:*** Activities developed to identify the on-going operation and maintenance measures required to keep stormwater management facilities and their components functioning in accordance with design objectives and permit requirements.

***Outfall:*** A location where collected and concentrated water is discharged. Outfalls include discharge from stormwater management facilities, drainage pipe systems, and constructed open channels.

**Parking Area:** Any area which can be used by motor vehicles, recreational vehicles, trailers, and boats for parking, including driveways and access aisles providing access to the parking stalls.

**Pollutant:** An elemental or physical product that can be mobilized by water or air and creates a negative impact on the environment. Pollutants include suspended solids (sediment), heavy metals (such as lead, copper, zinc, and cadmium), nutrients (such as nitrogen and phosphorus), bacteria and viruses, organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers), floatable debris, and increased temperature.

**Post-Developed Condition:** A project's site plan of impervious surface and landscaping after development.

**Pre-Developed Condition:** The project site's surface conditions prior to the proposed development.

**Privately Engineered Public Improvement (PEPI):** A publicly maintained facility that is designed, constructed, and financed by a private developer, entity, or its agent.

**Public Works Project:** Any development conducted or financed by a local, state, or federal governmental body and includes local improvements and public improvements.

**Retention Facility:** A facility designed to receive and hold stormwater runoff. Rather than storing and releasing the entire runoff volume, retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation. In this way, the full volume of stormwater that enters the facility is not released off-site.

**Retrofit:** Installation of a new stormwater facility to treat stormwater from existing impervious area, including, but not limited to existing roofs, patios, walkways, and driving or parking surfaces.

**Roadway:** Any paved surface used to carry vehicular traffic (cars/trucks, forklifts, farm machinery, or any other large machinery).

**Runoff:** The resulting stormwater flows across the ground surface during and after a rainfall event.

**Stormwater:** Water runoff that originates as precipitation on a particular site, basin, or watershed.

**Stormwater Facility Landscaping:** The vegetation (plantings), topsoil, drain rock, and other surface elements associated with stormwater management facility design.

**Stormwater Management:** The overall culmination of techniques used to reduce pollutants from, detain and/or retain, and provide a discharge location for stormwater to best preserve or mimic the natural hydrologic cycle on a development site. Public health

and safety, aesthetics, maintainability, capacity of existing infrastructure, and sustainability are important characteristics of a site's stormwater management plan.

**Stormwater Management Facility:** Any structure or configuration of the ground that is used as, or by its location becomes, a place where stormwater flows or is accumulated, including but not limited to, pipes, manholes, catch basins, ponds, open drainage ways, runoff control facilities, wetlands, and their accessories.

**Stormwater Quality Facility:** Any structure or drainage device that is designed, constructed, and maintained to collect and filter, retain, or detain surface water runoff during and after a storm event for the purpose of maintaining or improving surface and/or groundwater quality.

**Surface Conveyance:** The transport of stormwater on the ground surface from one point to another.

**Surface Infiltration Facility:** A facility designed to receive and infiltrate stormwater runoff at the ground surface to meet stormwater flood control requirements.

**Surface Retention Facility:** A facility designed to receive and hold stormwater runoff at the ground surface. Rather than storing and releasing the entire runoff volume, surface retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation.

**Tenant Improvements:** Upgrades made to the interior or exterior of buildings to meet the needs of the tenant. Tenant improvements may trigger **Chapter 3.0** Source Controls if they take place on sites with specified high-risk activities.

**Time of Concentration ( $T_c$ ):** The amount of time it takes stormwater runoff to travel from the most distant point (measured by travel time) on a particular site or drainage basin to a particular point of interest, such as to an on-site retention system.

**Total Suspended Solids (TSS):** Matter suspended in stormwater excluding litter, debris, and other gross solids exceeding 1 millimeter in diameter.

**Underground Injection Control (UIC):** A federal program under the Safe Drinking Water Act, delegated to the Oregon Department of Environmental Quality (DEQ), which regulates the injection of water below ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination.

**Vegetated Facilities:** As used in this manual, stormwater management facilities that rely on plantings to enhance their performance. Plantings can enhance many facility functions, including infiltration, pollutant removal, water cooling, flow calming, and prevention of erosion.

**Volume-Based Facility:** A stormwater quality facility, such as a wet pond, which is sized to store and treat a particular volume of runoff.

**Water Body:** Water bodies include rivers, streams, sloughs, drainages including intermittent streams and seeps, ponds, lakes, aquifers, wetlands, and coastal waters.

**Water Quality:** The chemical, physical, and biological characteristics of stormwater. Stormwater quality and flow control are two components of water quality management in stormwater runoff.

**Water Quality Design Storm:** A theoretical storm for estimating the amount of stormwater runoff to be treated.

## 1.5 PREPARING A STORMWATER MANAGEMENT PLAN

The intent of this section is to assist with an applicant's stormwater facility planning efforts. **These steps are not required** for design, permit, or construction approvals, yet are useful to consider when preparing stormwater management plans.

### Step 1 – Layout Your Proposed Footprint

Prepare a site plan that shows all existing development, proposed development and the grading details of the site.

### Step 2 – Identify Your Stormwater Management Needs

**Flood Control:** All stormwater runoff from impervious surfaces must discharge to approved discharge points (Eugene Code 9.6791, **Appendix A**). Identify existing impervious surfaces, the existing stormwater discharge points for those existing impervious surfaces, and the available existing stormwater systems. For more information on “Stormwater Flood Control” see **Section 1.6** of this manual.

**Stormwater Quality:** Generally, all development and redevelopment land use applications and building permits that propose 1000 square feet or more of new or replaced impervious surface must treat the stormwater runoff from that impervious area on-site before discharging to the public stormwater system (for exemption review, see Eugene Code 9.6792, **Appendix A**). For more information on “Stormwater Quality” see **Section 1.7** of this manual.

**Oil Control:** Eugene Code 9.6794 (**Appendix A**)

**Flow Control:** Stormwater runoff from non-residential development sites that will be conveyed by an open drainage way located in a Headwaters Stream (see map, **Appendix J**), may require retention or detention (see Eugene Code 9.6793 for specific code requirements). For more information on “Flow Control” see **Section 1.9**. If the site is at or above elevation 500 feet, and using a vicinity map, trace the stormwater runoff flow pattern from the development site to an elevation below 500 feet. If the stormwater runoff does not enter a Headwater Stream, no flow control standards are needed.

**Source Controls:** Site uses and characteristics such as, fuel dispensing, above ground storage of liquids and bulk storage, material transfer areas, loading docks, solid waste storage, vehicle and equipment washing areas, and parking areas may trigger additional water quality measures. For specific code requirements on what uses and characteristics will require additional measures, see Eugene Code 9.6795. Typical source control measures include covering potential pollutant areas, paving the areas to protect the underlying soils, hydraulically isolating drainage patterns, and containing potential pollutants. **Chapter 3** of this manual will provide details on which measures to implement.

### Step 3 – Evaluate Your Development Site and Development Plan

Identify the types of soils and infiltration rates of the soils. Identify the ultimate discharge point(s) of the stormwater runoff from the site. Calculate your new/replaced impervious surface area(s).

#### **Step 4 – Identify Your Flood Control Plan**

Identify where the stormwater runoff from new ore replaced impervious surface area(s) will be discharged. Confirm that system has flood control capacity. For guidance evaluating capacity, see **Section 1.6** “Stormwater Flood Control” of this manual.

#### **Step 5 – Identify Your Stormwater Quality Plan**

Evaluate whether the site has infiltration potential. If the site cannot infiltrate runoff, evaluate whether filtration treatment can be located on-site. Calculate the treatment facility size(s) and locate facilities on the site plan of the proposed development. If there is insufficient area for the treatment facilities, implement mechanical treatment. For guidance on “Stormwater Quality”, see **Section 1.7** of this manual.

#### **Step 6 – Select Your Stormwater Facilities**

Select and design an approved stormwater facility from those provided in **Chapter 2** of this manual.

#### **Step 7 – Develop an Operation & Maintenance Plan**

Applicants are responsible for on-going operation and maintenance of stormwater facilities. Select and prepare an operation and maintenance plan as outlined in **Chapter 4** of this manual.

#### **Step 8 - Technical Assistance**

At any time during the planning, designing, or permitting process, you may contact the City of Eugene for technical assistance. To request a consultation or speak with someone about the stormwater development standards that apply to your project, call 541-682-5086.

## 1.6 STORMWATER FLOOD CONTROL

### 1.6.1 The Purpose of Stormwater Flood Control

Stormwater flood control refers to managing the discharge of stormwater runoff generated by large, intense rainfall events for the purpose of protecting life and property from flood and drainage hazards by maintaining the capacity of the city's stormwater conveyance system.

All development permit applications and land use applications are required to discharge their stormwater runoff into discharge facilities having the capacity to remove the stormwater runoff from the basin without creating a risk of flooding or flood damage to other properties in the basin. Applicants may discharge their runoff into off-site stormwater facilities that have capacity or retain or detain flows on-site with an approved infiltration facility.

Off-site flow methods include discharge to drainage ways (including roadside ditches and natural drainages and streams), rivers, and engineered stormwater facilities (including culverts, pipes, channels, or other structures). On-site infiltration methods include surface infiltration and underground injection system infiltration.

The appropriate discharge point is site-specific and depends on a number of factors, including soil type, slopes, and availability of public and private infrastructure. Off-site discharge to conveyance facilities under the ownership of Lane County or the Junction City Water Control District will require the review and approval from the corresponding agency.

### 1.6.2 Flood Control Design Methodology

The Rational Method flow calculation, using the Flood Control Design Storm information and desired level of protection provided in **Appendix K**, must be used when evaluating the capacity of the discharge stormwater facility. When determining the basin area, include all developments in the drainage basin area draining into the facility having tentative or final plan approval at the time of your submitted application.

### 1.6.3 Off-Site Stormwater Facilities

Development permit applicants discharging runoff to manmade drainage systems designed to accommodate the runoff generated by the stormwater basin area do not need to provide additional analysis of the system for their proposed development. The City of Eugene has developed a flood control strategy for each of the drainage basins within the Urban Growth Boundary and published its findings in the adopted Stormwater Basin Master Plans. The Stormwater Basin Master Plans can be used to determine whether the manmade drainage system to which runoff from the development site will discharge was designed to accommodate runoff generated by the stormwater basin area.

Development permit applications discharging to manmade drainage systems not designed to accommodate runoff generated by the basin area and **all** land use applications must demonstrate the off-site flood control facility has capacity to carry post-construction stormwater runoff as outlined in **Section 1.6.2** above or retain or detain runoff on-site or construct a new flood control facility that has flood control capacity.

#### **1.6.4 On-Site Retention and Detention**

On-site retention and detention includes structural detention facilities and infiltration facilities having the ability to store and infiltrate the Flood Control Design Storm presented in **Appendix K**. When using infiltration options, the facility must either be located outside infiltration limited areas as identified on the City's Infiltration Limited Areas Map (See **Appendix I**) or the design professional must prove the viability of on-site infiltration using one of the following Infiltration Testing methods:

- Open pit falling head,
- Encased falling head, or
- Double ring infiltrometer

#### **1.6.5 Underground Injection Control Structures (UICs)**

Underground Injection Control Structures are regulated under the Safe Drinking Water Act. The UIC Program is administered by the Oregon Department of Environmental quality. This section provides general information only. Complete regulations and requirements are available on the Oregon Department of Environmental Quality (DEQ) website: <http://www.deq.state.or.us/wq/uic/uic.htm>. The DEQ can also be contacted at 503-229-5696.

Owners or operators of new and existing UICs are required to register and provide inventory data to DEQ. This information helps DEQ determine if the UIC is eligible for "rule authorization." Rule authorization allows the owner or operator to operate the UIC without a permit from DEQ. UICs that do not qualify for rule authorization must either be closed, modified to meet requirements for rule authorization, or the owner must submit a water pollution control facility permit application to DEQ and obtain a permit.

Compliance with DEQ criteria for rule authorization must be demonstrated during the registration process. Compliance can generally be more readily accomplished if stormwater management efforts focus on maximizing source controls, using surface vegetated water quality facilities, and disposing of stormwater through surface infiltration or shallow subsurface facilities.

Registration and inventory data should be submitted to DEQ at least 60 days in advance of potential start of construction. In some cases, DEQ and the City will need additional information from the applicant in order to make a determination on the potential for use of a UIC.

## 1.7 STORMWATER QUALITY

### 1.7.1 The Purpose of Stormwater Quality

The purpose of stormwater quality is to reduce runoff pollution and mitigate the volume, duration, time of concentration and rate of stormwater runoff from development by implementing low impact development practices and green infrastructure while capturing and treating 80% of the annual average rainfall. This runoff collects and transports pollutants to downstream receiving waters. Pollutants include:

- Suspended solids (sediment)
- Heavy metals (dissolved and particulate, such as lead, copper, zinc, and cadmium)
- Nutrients (such as nitrogen and phosphorus)
- Bacteria and viruses
- Organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers)
- Floatable debris
- Increased thermal load (temperature)

### 1.7.2 Stormwater Quality Design Methodologies

Stormwater quality facilities shall be designed, at a minimum, to treat the Water Quality Design Storm. Stormwater quality facilities which are designed using an approach other than the Simplified Approach must be sized using the following design values:

**Flow-rate based design:** Swales, oil/water separators, and proprietary treatment systems shall be sized to treat a rate of flow draining through them.

- A rainfall intensity of 0.13 inches per hour shall be used to design the off-line conveyance type facilities.
- A rainfall intensity of 0.22 inches per hour shall be used to design the on-line conveyance type facilities.

**Combination rate/volume based design:** Other stormwater quality facilities, such as stormwater planters, rain gardens, sand filters, drywells and soakage trenches shall be sized to treat a volume of runoff.

- When using the SBUH (see **Appendix M**), facilities shall be designed to treat runoff generated by 1.4 inches of rainfall over 24 hours (with NRCS Type 1A rainfall distribution)

See **Appendix L** for more detailed information regarding the formulation of Eugene's stormwater quality standards and Water Quality Design Storm.

## **1.8 OIL CONTROL FOR HIGH-RISK VEHICLE AND EQUIPMENT TRAFFIC AREAS**

Oil controls can include either (1) spill control manholes presented in **Section 2.3.14** or (2) the incorporation of Lynch-type catch basins within the parking lot or prior to discharging to stormwater quality facilities. The discharge of stormwater with a visible sheen off-site or into on-site UIC's is prohibited.

## 1.9 FLOW CONTROL

Flow control is intended to protect downstream properties, infrastructure, and natural resources from the increases in stormwater runoff peak flow rates and volumes resulting from development.

The City's policy is to ensure that runoff leaving the post-development site:

- Does not exceed the capacity of the receiving conveyance facility
- Does not increase the potential for stream bank and channel erosion
- Does not create or increase any flooding problems

Flow controls are required in the Headwaters Area of Eugene (see the Headwaters Streams Map in **Appendix J**). For construction of new or replaced impervious surface in this area, on-site infiltration or on-site detention is required to control stormwater volumes and flow rates. Regardless of the method used, flow control shall be sufficient to maintain peak flow rates at or below their pre-development levels for storms larger than the Water Quality Design Storm and smaller than the Flood Control Design Storm.

Flow control is also required for development in areas where the downstream capacity of an open or closed stormwater system is not sufficient to convey the post development flows.

To meet the flow control requirements, surface infiltration and filtration facilities are required to the maximum extent feasible. Impervious area reduction techniques may also be used to reduce runoff. Structural systems can be used as a last option to provide storage capacity. Flow control facilities include detention and retention:

### **DETENTION FACILITIES**

Detention facilities temporarily store stormwater runoff in a pond, tank, vault, or pipe. The water is slowly released from the facility, typically over a number of hours.

### **RETENTION FACILITIES**

Retention facilities also store stormwater runoff. Rather than storing and releasing the entire runoff volume, however, the facility permanently retains a portion of the water on-site, where it infiltrates and recharges the groundwater aquifer, and in the case of surface retention facilities, evaporates or is absorbed and used by surrounding vegetation. Retention facilities reduce the total volume of water released downstream.

## **1.10 INTERLOT DRAINAGE**

Interlot drainage refers to stormwater flow across property boundaries. This may include sheet flow, minor open channels and enclosed storm drain pipe systems, upon private properties that serve only to collect and remove stormwater runoff generated within the boundaries of private properties. All maintenance of interlot drainage systems is the responsibility of the property owner or abutting property owners.

## **1.11 OTHER REGULATORY STORMWATER PROGRAMS**

Conformance with this manual's requirements does not relieve the applicant of other applicable local, state, or federal regulatory or permit requirements. This manual is intended to complement any additional regulation, and is not expected to conflict with, exclude, or replace those regulations. Some of the more common additional regulations that may apply are summarized below.

### **1.11.1 Illicit Discharge Program**

The City expects spill response supplies, such as absorbent material and protective clothing, to be available at all potential spill areas. Employees should be familiar with the site's operations and maintenance plan and/or proper spill cleanup procedures.

### **1.11.2 Industrial Pretreatment Program**

Some facilities may be required to obtain a State of Oregon NPDES stormwater permit before discharging to the City's storm sewer system or to waters of the state. Applicants may also be required to obtain an industrial wastewater permit for discharges to the wastewater system. Facilities subject to these requirements are generally commercial or industrial facilities. Typical discharges include process wastewater, cooling water, or other discharges generated by facilities identified in this manual that drain to the City stormwater or wastewater systems. Contact Public Works Wastewater Division staff at 541-682-8600 for a list of current wastewater discharge limits.

An evaluation will be done during the building permit review process to determine if an industrial discharge permit is required. If a permit is required, the industrial permit application process will be independent of the building permit review/issuance process. However, building permit applications may have to be revised to accommodate industrial permitting compliance requirements (*i.e.* sampling points, pretreatment facilities, *etc.*).

### **1.11.3 Oregon DEQ Underground Injection Control (UIC) Program**

The Oregon Department of Environmental Quality (DEQ) identifies drywells, sumps, and piped soakage trenches as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. Because the UIC Program states that these types of wells may have a direct impact on groundwater, registration or permitting with DEQ is required. See **Section 1.6.5** for additional information.

### **1.11.4 Other Local, State, and Federal Programs**

Other applicable codes or regulations, include, but are not limited to the hazardous substances storage requirements of articles 79 and 80 of the Oregon State Fire Code; the spill prevention control and containment (SPCC) regulations of 40 CFR 112 (EPA); and the Resource Conservation and Recovery Act (RCRA).

Additional City of Eugene and Oregon Department of Environmental Quality (DEQ) permit requirements may apply. Contact Public Works staff at 541-682-8600 for additional information about stormwater or wastewater discharges to City-owned wastewater or stormwater systems.

FEMA Special Flood Hazard Area may apply to larger drainage channels. Please contact the Permit and Information for applicable flood control standards.

The City of Eugene requires erosion prevention permits for any construction activities that disturb an area one acre or greater in size or disturb more than 500 square feet or involve the excavation or placement of 20 cubic yards of material within a sensitive area. A site is considered a sensitive area if it meets one of the following criteria:

- The slope of the site is greater than 10%,
- The site contains highly erodible soils, or
- The site has the potential to directly drain into a water feature or its designated buffer area.

## **1.12 STORMWATER MANAGEMENT RETROFITS**

Retrofits help the City incrementally provide the stormwater management for runoff from existing development. Any retrofit required as part of a land use decision, development permit or building permit must meet the standards set forth in the code and the Stormwater Management Manual.

Voluntary retrofits of private facilities with the intent to qualify for system impact credits or fee reductions must meet the standards set forth in the Stormwater Management Manual to qualify. All other voluntary retrofits of private facilities are encouraged to use the Stormwater Management Manual for guidance but are not required to comply given there are no permits or approvals required for the specific work (i.e., land use, building permits, UIC, etc.).

## 1.13 STORMWATER SYSTEM DEVELOPMENT CHARGES

Stormwater Systems Development Charges (SDC's) provide a funding mechanism to account for the costs and value of public infrastructure system capacity required by new development. SDC methodology includes a rate for providing stormwater quantity and quality capacity and a rate for providing public off-site low impact development (LID) water quality facilities off-site. The LID component provides for off-site public infiltration/filtration stormwater quality treatment to be paid only by development subject to the 2014 low impact development water quality treatment standards that does not construct private on-site stormwater infiltration or filtration treatment facilities. The LID component cost of the increased SDC is roughly comparable to the cost of constructing an equivalent on-site stormwater treatment facility.

### 1.13.1 Credits

Stormwater *quantity* credits for SDC's and Utility Billing monthly user fees are based on a public system benefit from development reducing the quantity of stormwater entering the public system through on-site retention methods. Developments utilizing private means for reducing the quantity of water discharged from a development site to the public system can reduce the demand for additional capacity in downstream public water conveyance facilities. Establishing stormwater quantity SDC and user fee credits provides a general recognition of reduced demand.

Stormwater *quality* credits for SDC's and user fees are based on a public system benefit from development treating stormwater quality through privately constructed and maintained facilities and effective impervious area reduction techniques. Developments utilizing private means for operation and maintenance of water quality treatment can reduce the demand for downstream public facilities for water quality treatment. Establishing stormwater quality SDC and user fee credits provides a general recognition of reduced demand and provides a modest incentive for meeting and exceeding minimum water quality treatment requirements.

Implementation of stormwater quality SDC and user fee credits is related to adoption of stormwater development standards which require water quality treatment at sites of new development. Adopted standards provide a basis for evaluation of the degree of impact reduction of a development. These credits recognize impact reduction and provide incentives for stormwater quality across three types of development sites:

- Those not subject to the standards for stormwater quality but which treat all or a portion (minimum 20%) of the total impervious area of the development site;
- Sites where a portion of the site impervious area is subject to the standards for stormwater quality but which treat runoff from 20% or more impervious area than the minimum required, or which reduce a minimum of 20% of the total impervious area of the development site through use of impervious area reduction techniques; and,
- Sites where all of the site impervious area is subject to the standards for stormwater quality but which reduce a minimum of 20% of the total impervious area of the development through the use of impervious area reduction techniques.

See the adopted City of Eugene Systems Development Charges (SDC) Methodologies document for SDC credits. See the adopted City of Eugene Stormwater Service Charges methodology document for user fee credits.

Stormwater *LID* credits for SDC's are available only to those paying the LID capacity component and based on a decreased public system burden from development treating stormwater quality through privately constructed and maintained mechanical treatment facilities. Private mechanical treatment facilities alone remove pollutants but do not provide the full benefits of LID treatment facilities. A single-level stormwater quality SDC credit of 50% of the LID capacity component of the stormwater SDC will be applied to development choosing to install an approved on-site mechanical treatment facility that treats all site impervious area subject to the standards for stormwater quality.

## **1.14 EQUIVALENT ON-SITE AREA GUIDELINES**

Equivalent on-site areas are existing impervious surface areas that would otherwise not require stormwater quality treatment, being an equal or greater surface area of the new or replaced impervious surface area that requires stormwater quality treatment of its stormwater runoff.

When designing a stormwater quality system using equivalent on-site areas, plans shall show and identify the following information:

- The new or replaced impervious surface areas which, by code, require stormwater quality treatment of its stormwater runoff.
- The new or replaced impervious surface areas which, by code, require stormwater quality treatment of its stormwater runoff, but will not receive stormwater quality treatment.
- The equivalent on-site (i.e. existing) impervious surface areas which will receive stormwater quality treatment of its stormwater runoff.

Using the square footages from the bulleted items above, the stormwater quality treatment facilities shall be sized using either the Simplified or Presumptive Approach.

The use of equivalent on-site areas to meet stormwater quality standards does not exempt new or replaced impervious surfaces from having to meet flood control, flow control, oil control, or source control standards. The redesign of existing surfaces must meet current codes, including stormwater management.

## Chapter 2.0

# SELECTING, DESIGNING, CONSTRUCTING AND LANDSCAPING STORMWATER MANAGEMENT FACILITIES

This chapter provides procedures for selecting and designing stormwater facilities that provide stormwater flood control, quality, and flow control. It includes:

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## **2.1 INTRODUCTION**

Stormwater facilities presented in this chapter satisfy the standards established for stormwater quality, flow control, flood control, and in some cases a combination of the three. Two sizing methodologies are included in this chapter: the simplified and presumptive approaches. Each sizing approach has limitations on application, particularly as related to the soil types on-site. Soil formations are classified by NRCS soil types A, B, C, or D. For the purposes of this manual, NRCS soil types A & B are presumed to have infiltration rates of 2" per hour and greater. NRCS soil types C & D are assumed to have infiltration rates less than 2" per hour.

## **2.2 STORMWATER FACILITIES**

This section identifies techniques to reduce impervious surface treatment areas and the three classifications of stormwater quality facilities.

### **2.2.1 Impervious Area Reduction Techniques**

Contained Planters, Eco roofs, Permeable Pavements, and Tree Credits are impervious area reduction techniques. These techniques reduce the effective area of impervious surface and reduce the size of the resulting stormwater quality facility. Impervious area reduction techniques reduce runoff pollution and mitigate the volume, duration, time of concentration and rate of runoff. Eco roofs, permeable pavements, and trees intercept rainfall directly and are not allowed to receive stormwater runoff from other impervious surface areas. Contained Planters may either intercept the rainfall or receive stormwater runoff from impervious surface areas if sized using the Presumptive Approach. All impervious area reduction techniques may be used for private facilities. Impervious area reduction shall not be used for public facilities.

### **2.2.2 Infiltration Treatment Facilities**

Infiltration treatment facilities require soils that drain well and infiltrate 2 inches per hour or greater. Infiltration treatment facilities require an overflow to an approved point of discharge unless they are sized to fully infiltrate the Flood Control Design Storm event. When sized for flood control, infiltration treatment facilities must infiltrate the Flood Control Design Storm Event within 30 hours.

### **2.2.3 Filtration Treatment Facilities**

Filtration treatment facilities are appropriate for sites with soils that infiltrate less than 2 inches per hour, have bedrock less than 5 feet below the surface, groundwater elevations less than 6 feet or slopes greater than 10%. They include a surface overflow and an underdrain in the gravel layer where treated flow is routed to an approved discharge point. Lined filtration treatment facilities may be approved on sites with steep slopes, high groundwater, or contamination and when located next to structures or property lines to protect foundations, basements, and adjacent properties. Otherwise the use of liners is discouraged to maximize what infiltration is available from native soils.

### **2.2.4 Mechanical Treatment Devices**

Manufactured treatment devices must be selected from the list of approved proprietary treatment technologies and sized using the Presumptive Approach. Proprietary treatment

technologies that are not on the approved list may be used in a “treatment train,” to provide additional treatment when approved by the City. Manufactured treatment devices must be able to fully treat the peak runoff from the Water Quality Design Storm and fully bypass the peak flows from the Flood Control Design Storm.

### **2.2.5 Facility Underdrains and Surface Overflows**

It is important to note the distinction between an underdrain and a surface overflow. While both the underdrain and the overflow require a connection to an approved discharge point, the underdrain is typically set at an elevation below the growing medium to drain treated flows that pass through the growing medium and are trapped in a facility where the surrounding soils infiltrate 2” per hour or less. An overflow is typically set at an elevation above the growing medium and is included to drain flows exceeding the stormwater quality design capacity of the facility or in case the vegetated facility becomes clogged.

### **2.2.6 Source Control Devices**

Source control devices include Spill Control Manholes and oil/water separators. They are used to meet the source control requirements specified in **Chapter 3**.

## 2.3 FACILITY DESIGN CRITERIA

This section provides a description and the specific design requirements for each stormwater facility listed below. Typical design drawings are provided in **Appendix B**. Variations that exist between the Simplified Approach and Presumptive Approach and variations between public and private facilities are identified.

Table 2-1 identifies the approved sizing methods for each facility type as well as the conformance with stormwater management standards given for each facility type.

Table 2-1 Sizing methods and conformance with stormwater management standards for each facility type

	Facility	Sizing Approaches		Stormwater Management Standard		
		Simplified	Presumptive	Water Quality	Flow Control	Flood Control
<b>Impervious Area Reduction Techniques</b>						
2.3.3	Contained Planter	X	X			
2.3.4	Eco roof	X	X			
2.3.5	Permeable Pavement	X	X			
2.3.6	Tree Credit	X	X			
<b>Infiltration Treatment Facilities</b>						
2.3.8	Pond		X	X	X	X
2.3.9	Rain Garden	X	X	X	X	X
2.3.10	Sand Filter	X	X	X	X	X
2.3.11	Stormwater Planter	X	X	X	X	X
<b>Filtration Treatment Facilities</b>						
2.3.7	Filter Strip	X	X	X		
2.3.8	Pond		X	X	X	X
2.3.9	Rain Garden	X	X	X	X	X
2.3.10	Sand Filter	X	X	X	X	X
2.3.11	Stormwater Planter	X	X	X	X	X
2.3.12	Swale	X	X	X	X	X
<b>Mechanical Treatment Facilities</b>						
2.3.13	Proprietary Treatment Devices		X	X		
<b>Source Control Devices</b>						
2.3.14	Spill Control Manhole		X		X	
<b>Detention Facilities</b>						
2.3.15	Structural Detention Facility		X		X	
<b>Underground Injection Systems</b>						
2.3.16	Drywell		X			X
2.3.17	Soakage Trench		X			X

Notes: Flow Control and Flood Control Credit are given when facilities are sized to accommodate design events per the simplified and presumptive methods.

### **2.3.1 Public Stormwater Facilities**

The City will operate and maintain only certain types of stormwater facilities. Stormwater facilities that can be located in dedicated public rights of way and public easements are: Filter Strips, Ponds, Rain Gardens, Stormwater Planters, Swales, Proprietary Treatment Devices, Spill Control Manholes, and Structural Detention Facilities. In addition to the stormwater quality sizing and design requirements set forth in this manual, public facilities must be designed in compliance with the Public Improvement Design Standards (PIDS) Manual and Eugene adopted Oregon Standard Specifications for Construction.

### **2.3.2 Private Stormwater Facilities**

In addition to the stormwater quality sizing and design requirements set forth in this manual, private stormwater facilities must be designed in compliance with the Uniform Building and Uniform Plumbing Codes.

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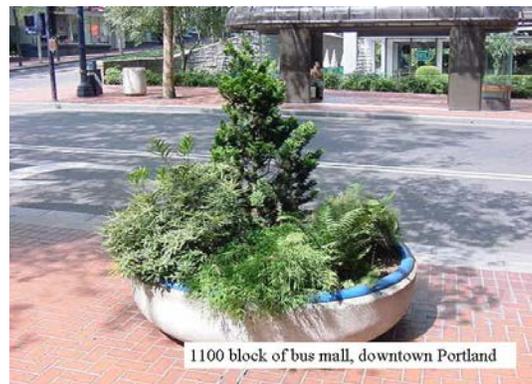
### 2.3.3 Contained Planter

#### **Facility Description**

**Contained Planters** are free-standing plant containers placed over impervious surfaces such as patios, sidewalks, and rooftops that intercept and filter rainfall that would otherwise contribute to stormwater runoff from the underlying impervious surface.

Contained planters may be prefabricated pots of various dimensions or may be constructed in place and have an infinite variety of shapes and sizes. Contained Planters intercept precipitation only when sized under the Simplified Approach, not stormwater runoff from other impervious areas. Runoff from other impervious areas is allowed when sized under the Presumptive Approach. Drainage is allowed through the bottom of the planter onto the impervious surface.

Contained Planters meet the stormwater management standard for impervious area reduction techniques.



#### **Design Requirements**

**Sizing:** Contained Planters replace impervious area at a 1:1 ratio.

**Soil Suitability:** Contained Planters are appropriate for all soil types, as they are typically placed over impervious surface. The growing medium shall be a minimum 12 inches of topsoil.

**Setbacks:** Not applicable.

#### **Materials**

**Planter Walls:** Planter walls shall be made of stone, concrete, brick, clay, plastic, wood, or other stable material. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

#### **Vegetation**

Contained Planters shall be planted to cover at least 50% of the planter surface. Plants shall be relatively self-sustaining, with little need for fertilizers or pesticides. Irrigation is optional, although plant viability must be maintained. Planters tend to dry out more quickly due to reflective heat. Insulation to protect roots may be necessary. Trees are encouraged and may qualify for additional impervious area reductions.

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## 2.3.4 Eco-Roof

### **Facility Description**

**Eco-Roofs** are impervious area reduction techniques. Eco-Roofs are vegetated roof systems used in place of conventional roofs. Eco-roofs provide stormwater management by capturing, filtering, and, depending on the season, evapo-transpires precipitation while providing aesthetic and energy conservation benefits.

Eco-Roofs meet the stormwater management standard for impervious area reduction techniques.

### **Design Requirements**

**Sizing:** Eco-Roofs replace impervious area at a 1:1 ratio. They are not allowed to receive water from other impervious areas.

**Slope:** Maximum roof slope shall be 25% unless the applicant can provide documentation for runoff control on steeper slopes.

**Drain:** As with a conventional roof, an Eco-Roof must safely drain runoff from the roof to an approved stormwater destination.

### **Materials**

**Structural Roof Support:** The structural roof support must be sufficient to hold the additional weight of the Eco-Roof. For retrofit projects, check with an architect, structural engineer, or roof consultant to determine the condition of the existing building structure and what might be needed to support an Eco-Roof. This might include additional decking, roof trusses, joists, columns, and/or foundations. Generally, the building structure must be adequate to hold an additional 10 to 25 pounds per square-foot (psf) saturated weight, depending on the vegetation and growth medium that will be used. (This is in addition to snow load requirements.) An existing rock ballast roof may be structurally sufficient to hold a 10-12 psf Eco-Roof. (Ballast typically weighs 10-12 psf.)

**For New Construction:** The project architects and structural engineers shall address the structural requirements of the Eco-Roof during the design process. Greater flexibility and options are available for new buildings than for re-roofing. The procedures for the remaining components are the same for both re-roofing and new construction.

**Waterproof Membrane (Impermeable Material):** Good quality waterproofing material must be used on the roof surface. Waterproof membranes are made of various materials, such as modified asphalts (bitumens), synthetic rubber (EPDM), hypolan (CPSE), and reinforced PVC. Some of the materials come in sheets or rolls and some are in liquid form. They have



different strengths and functional characteristics. Some of these products require root inhibitors and other materials to protect the membrane. Numerous companies manufacture waterproofing materials appropriate for Eco-Roofs.

Protection Boards or Materials: These materials protect the waterproof membrane from damage during construction and over the life of the system, usually made of soft fibrous materials.

Root Barrier (if needed): Root barriers are made of dense materials that inhibit root penetration. The need for a root barrier depends on the waterproof membrane selected. Modified asphalts usually require a root barrier, while synthetic rubber (EPDM) and reinforced PVC generally do not. Check with the manufacturer to determine if a root barrier is required for a particular product. Membranes impregnated with pesticides are not allowed. Manufacturers shall disclose the concentration of leach out for membranes impregnated with copper.

Drainage Layer (if needed): There are numerous ways to provide drainage. Products range from manufactured perforated plastic sheets to a thin layer of gravel. Some Eco-Roof designs do not require any drainage layer other than the growth medium itself, depending on roof slope and size (for example, pitched roofs and small flat roofs).

Gravel Ballast (if needed): Gravel ballast is sometimes placed along the perimeter of the roof and at air vents or other vertical elements. The need for ballast depends on operational and structural design issues. It is sometimes used to provide maintenance access, especially to vertical elements requiring periodic maintenance. In many cases, very little, if any, ballast is needed. In some situations a header or separation board may be placed between the gravel ballast and adjacent elements (such as soil or drains). If a root barrier is used, it must extend under the gravel ballast and growth medium, and up the side of the vertical elements.

## **Vegetation**

Eco-Roof vegetation should have the following attributes:

- Drought-tolerant, requiring little or no irrigation after establishment
- Growth patterns that allow the plants to thoroughly cover the soil (at least 90% of the overall surface should be covered and maintained within 2 growing seasons)
- Self-sustaining, without the need for fertilizers, pesticides, or herbicides able to withstand heat, cold, and high winds
- Very low-maintenance, needing little or no mowing or trimming
- Perennial or self-sowing
- Fire resistant

A mix of sedum/succulent plant communities is recommended because they possess many of these attributes. Herbs, forbs, grasses, and other low groundcovers can also be used to provide additional benefits and aesthetics; however, these plants may need more watering and maintenance to survive and keep their appearance.

Four methods (or combinations of them) are generally used to install the vegetation: vegetation mats, plugs/ potted plants, sprigs, and seeds.

1. Vegetation mats are sod-like, pre-germinated mats that achieve immediate full plant coverage. They provide immediate erosion control, do not need mulch, and minimize weed intrusion. They also need minimal maintenance during the establishment period and little ongoing watering and weeding. Plugs or potted plants may provide more design flexibility than mats. However, they take longer to achieve full coverage, are more prone to erosion, need more watering during establishment, require mulching and more weeding.
2. Sprigs are hand-broadcast. They require more weeding, erosion control, and watering than mats.
3. Seeds can be either hand-broadcast or hydraseeded. Like sprigs, they require more weeding, erosion control, and watering than mats.
4. Soil coverage to prevent erosion shall be established immediately upon installation by using mulch, vegetation mats, or other approved protection method. Ninety-percent (90%) plant coverage should be achieved within 2 years. Temporary irrigation to establish plants is recommended. A permanent irrigation system using potable water may be used, but an alternative means of irrigation, such as air conditioning condensate or other non-potable sources, is recommended. Alternative sources should be analyzed to determine if the source has chemicals that might harm or kill the vegetation.

Growth Medium (Soil): The growth medium is generally 2 to 6-inches thick and well drained. It weighs from 10 to 25 pounds per square-foot when saturated. A simple mix of one-fourth topsoil, one-fourth compost, and one-half pumice perlite may be sufficient for most applications. Some companies have their own growth medium specifications. Other components may include digested fiber, expanded clay or shale, or coir.

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## 2.3.5 Permeable Pavements

### **Facility Description**

**Permeable Pavements** are impervious area reduction techniques. Permeable Pavements are pervious and porous load bearing structures with an underlying stone reservoir that temporarily stores and filters surface runoff before infiltrating into the subsoil or being collected in underlying drain pipes and being discharged off-site. Permeable pavements include, but are not limited to, pervious concrete, asphalt, plastic/concrete rings planted with grass, stone and block pavers. The system generally consists of a permeable wearing course surface placed upon layered permeable base materials.



Permeable pavements can be used in pedestrian areas, patios, plazas, parking lots, driveways and other traditionally hardscaped areas. Numerous products and design approaches are available, including special asphalt paving; manufactured concrete, plastic, and gravel products; paving stones; and brick. Permeable pavements must be installed and maintained to manufacturer's specifications. Permeable pavement systems that will be supporting vehicular traffic should be designed to accommodate traffic loading.

Permeable Pavements meet the stormwater management standard for impervious area reduction techniques.

### **Design Requirements**

**Sizing:** Permeable pavements replace impervious area at a 1:1 ratio. They are not allowed to receive runoff from other impervious areas. Runoff from the flood control event shall be accommodated through an approved point of discharge.

**Dimensions and Slopes:** Minimum/maximum dimensions and other specifications are product-specific and shall comply with the design or manufacturer's specifications. Slopes exceeding 5% shall demonstrate the ability to retain stored runoff. Slopes shall be less than 10% in all cases.

**Setbacks:** There are no required setbacks for pervious paver systems.

**Subgrade:** Permeable pavement should not be constructed over highly compacted soils. Compaction should be kept to minimum as not to decrease the permeability of native or import soils.

**Limitations:** Permeable Pavements shall not be used on sites with a likelihood of high oil and grease concentrations. These site uses include vehicle wrecking or impound yards, fast food establishments, automotive repair and sales.

Settlement can be expected due to the uniform gradation of materials.

## **Materials**

**Geotextile Fabric:** Subgrade geotextile for separation is required between subgrade (native soil) and aggregate base (gravel layer). Geotextile may also be required between the sand layer and the aggregate base as required by the product manufacturer.

**Aggregate Base:** A permeable layer of open graded base rock shall be provided for storage of runoff and the structural platform for the wearing surface. The aggregate base layer shall be designed to accommodate the specific volume of rainfall storage required and the anticipated surface design loads. In no case shall the layer be less than 6 inches. Diameter of aggregate base shall be no greater than 2-1/2 inch and no less than 3/4-inch.

**Bedding Course:** A layer of sand or small diameter aggregate shall be provided for permeable pavers as recommended by the manufacturer. The bedding course shall be no less than 1-inch thick.

**Paving Courses:** Paving courses shall be designed for the anticipated surface loads and the aggregate base layer design. All paving courses shall be permeable as to infiltrate stormwater directly into the aggregate storage layer. Asphalt mixes shall be of the open graded design. Permeable concrete mixes shall be of the open graded design with little or no sand. Permeable pavers and other premanufactured products should be installed per manufactures recommendations.

## 2.3.6 Trees

### **Facility Description**

**Trees** intercept precipitation and hold water on the leaves and branches and allow it to evaporate, Trees retain runoff and dissipate the energy of runoff. They also provide shade, providing two direct benefits. First, hard surfaces are protected from direct solar exposure, which reduces heat gain. The less heat gain there is in pavement, the less heat is absorbed by stormwater as it flows over the surface. Second, by shading pavement, the trees help reduce or minimize air temperature increases caused by the hot pavement. Cooler air may help prevent stream temperature increases associated with air temperatures.



These functions are most measurable for storms of less than 0.5 inches over 24 hours. While deciduous trees are not as effective during winter months, evergreen trees are effective year round for these smaller storms and portions of larger storms. Generally, large trees with small leaves are the most efficient rainfall interceptors. Trees also facilitate stormwater infiltration and groundwater recharge.

Trees meet the stormwater management standard for impervious area reduction techniques.

### **Design Requirements**

**New Evergreen and Deciduous Trees:** New large trees planted within 25 feet of ground-level impervious surfaces, and new small trees, or slowly growing larger trees, planted within 10 feet, are eligible for impervious area reduction. Trees may be applied to ground-level surfaces only; roofs may not reduce impervious area. A reduction of 100 square feet is given for new deciduous trees, and 200 square feet of reduction is given for new evergreen trees (see minimum sizes below). Impervious area reductions also apply to existing trees kept on a site if the trees' canopies are within 25 feet of ground-level impervious surfaces. The reduction is the square-footage equal to one-half of the existing tree canopy within the 25 foot area. No more than 10% of a site's impervious surface can be mitigated through the use of trees.

Trees used for impervious area reduction shall be clearly labeled on permit drawings.

Trees shall be maintained and protected on the site after construction and for the life of the development (50-100 years or until any approved redevelopment occurs in the future). During the life of the development, trees approved for impervious area reduction shall not be removed without approval from the City. Trees that are removed or die shall be replaced within 6 months with like species. All trees should be pruned to ANSI standards.

The trees selected shall be suitable species for the site conditions and the design intent. Trees should be relatively self-sustaining and long-lived. Temporary irrigation should be provided for native plantings. Long-term irrigation is optional.

New deciduous trees shall be at least 2 caliper inches and new evergreen trees must be at least 6 feet tall to receive Simplified Approach credit. Trees planted to meet stormwater management facility planting requirements, except those located in Contained Planters, may not also receive Impervious Area Reduction Technique credits on the SIM Form.

Trees used to meet stormwater management requirements shall be kept on a site and maintained properly to ensure continued stormwater benefits. Trees should be inspected 2 times a year and within 48 hours of a major wind or storm event.

Existing Trees: Impervious area reduction applies to existing trees of 4-inch caliper or larger. Large trees which reduce impervious area must be located within 25' of proposed or existing ground-level impervious surfaces; small trees must be located within 10' of proposed or existing ground level impervious surfaces. Impervious area reduction is based on one-half of the square footage of the tree canopy, measured within the drip-line.

Protection during construction shall be in conformance with the City's tree preservation standards. The applicant will have to provide documentation required by the City to ensure the tree will remain healthy after construction and during the life of the project. During the life of the development, trees approved for stormwater credit shall not be removed without approval from the City. Stormwater management functions of any removed trees shall be replaced on the site with other trees or stormwater management approaches. Trees that die shall be replaced within 6 months.

### 2.3.7 Filter Strip

#### **Facility Description**

**Filter Strips** are gently sloped vegetated or grassed areas that stormwater runoff is directed to flow over and filter through. Stormwater enters the filter as sheet flow from an impervious surface or is converted to sheet flow using a level spreader. Pollutants are removed through filtration and sedimentation.

There are an infinite number of ways to fit this concept into site designs and designers are encouraged to use the site landscape areas for this purpose. Filter Strips can be used to treat hydraulically isolated or irregularly shaped impervious areas such as driveways, walkways and patio areas. A filter strip may be used in hydraulically isolated areas where it can be demonstrated that no natural or formal stormwater conveyance system exists. Runoff patterns must conform to Oregon Drainage Law .

Filter Strips qualify as filtration facilities and meet the stormwater management standard for water quality.

#### **Design Requirements**

**Sizing:** The Simplified Approach shall be used to size Filter Strips receiving less than 1000 sf of impervious area or sheet flow runoff from continuous linear impervious areas of consistent cross section on a unit basis. Examples are driveways, patios, sidewalks, bike baths and narrow access roads less than 20 feet wide. Filter Strips shall use a sizing factor of 0.2 for water quality with the Simplified Method.

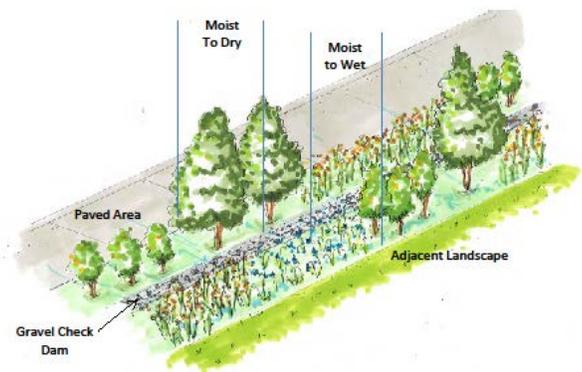
**Soil Suitability:** Filter Strips are appropriate for all soil types. Unless existing vegetated areas are approved as a filter, stormwater facility growing medium shall be used for the top 12 inches of the facility or the soil shall be amended to support plant growth.

**Setbacks:** The facility must begin 5 feet from the property line; 10 feet from buildings; and 50 feet from wetlands, rivers, streams, and creeks, unless otherwise approved by the City of Eugene.

**Dimensions and Slopes:** Filter Strips shall slope between 0.5 and 10 percent. Terraces may be used to decrease ground slopes. Slopes shall not exceed 5% for grassed facilities. Filter strip shall have a minimum width of 5 feet measured in the direction of flow.



Vegetated Filter Strip



Level Spreaders: A grade board, perforated pipe, or trench may be required to disperse the runoff evenly across the Filter Strip. The top of the level spreader must be horizontal and at an appropriate height to provide sheet flow directly to the soil without scour. Grade boards can be made of any material that will withstand weather and solar degradation. Trenches used as level spreaders can be filled with washed crushed rock, pea gravel, or sand. Exposed pipe should be protected from weather and solar degradation .

**Materials**

Check Dams: Check dams shall be installed every 10’ of facility measured in the direction of flow. Check dams shall be constructed of durable, non-toxic materials such as rock or brick or graded into the native soils. Check dams shall be 12 inches wide, 3 to 5 inches high, and run the length of the filter.

**Vegetation**

The Filter Strip must maintain 90 percent coverage by vegetation or 100 percent coverage by grass at establishment. Vegetation shall conform to the facility planting list located in **Appendix D**.

Vegetated filter strips shall be planted with minimum plant quantities from Schemes I, II or III. Minimum plant quantities are as follows:

<b>Vegetated Filter Strip Planting Scheme</b>	<b>I</b>	<b>II</b>	<b>III</b>
<b>Ground Cover</b> , 4-inch pots spaced 1’ on center (per 100 square feet of the facility)	100	80	60
<b>Small Shrubs</b> , 1 gal. pots spaced 2’ on center (per 100 square feet of the facility)		4	12

Grassy filter Strips must have 100 percent coverage by native grasses, turf grasses, native wildflower blends, native ground covers, or any combination thereof. Seed shall be applied at the rates specified by the supplier.

Plants and grass shall be established before water is allowed to enter the facility or biodegradable erosion control matting shall be installed in the flow area of the Filter Strip before allowing water to flow through the Filter Strip.

Public facilities shall be designed not to require mowing unless approved by the City of Eugene. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for publicly maintained facilities.

Growing Medium: Imported soils shall be a sandy loam mixed with compost or a sand/soil/compost blend. It shall be roughly one-third compost by volume, free-draining, and support plant growth. The compost shall be derived from plant material; animal waste is not allowed. The growing medium shall be minimum 12 inches deep for Filter Strips.

## 2.3.8 Ponds

### **Facility Description**

**Ponds** are artificial ponds designed to collect and retain/detain urban runoff. Three types of Ponds are described in this section: Wet Ponds, Extended Wet Ponds, and Dry Ponds. All of which must be designed and submitted under the Presumptive Approach.



The City encourages applicants to design Ponds to function as multipurpose facilities (e.g., parks, open space, or recreation facilities), provided that any alternative uses are compatible with the primary stormwater functions and maintenance standards.

Ponds qualify as infiltration and filtration facilities. Ponds meet the stormwater management standards for water quality, flow control and flood control when designed under the Presumptive Approach.

### **2.3.8.1 Wet Ponds**

**Wet Ponds** are constructed with a permanent pool of water (commonly referred to as pool storage or dead storage). Stormwater enters the pond at one end and displaces water from the permanent pool. Pollutants are removed from stormwater through gravitational settling and biological processes. When the sizing criteria presented in this section are used, water quality requirements are presumed to be met.

Additional facilities may be required in order to meet flow control requirements, as applicable. An overflow mechanism to an approved discharge point is required.

### **2.3.8.2 Extended Wet Ponds**

**Extended Wet Ponds** are also constructed with a permanent pool of water, but have additional storage above that fills during storm events and releases water slowly over a number of hours. The permanent pool is sized to provide stormwater quality, and the additional storage is sized to meet flow control requirements. Pollutants are removed from stormwater through gravitational settling and biological processes. When the sizing criteria presented in this section are used, stormwater quality requirements are presumed to be met. The extended detention must be designed using acceptable hydrologic modeling techniques to meet applicable flow control requirements. An overflow mechanism to an approved discharge point is required.

### **2.3.8.3 Dry Detention Ponds**

**Dry Detention Ponds** are designed to fill during storm events and slowly release the water over a number of hours. Dry Detention Ponds must be designed using acceptable hydrologic modeling techniques to meet applicable flow control requirements. Additional facilities are required in order to meet stormwater quality requirements, unless the bottom

flow path of the pond is designed as a Swale according to the Swale sizing and design criteria. An overflow mechanism to an approved discharge point is required.

### **Design Requirements**

**Sizing:** Wet and extended wet detention Ponds should be designed for drainage areas over 5 acres and up to 150 acres to help avoid problems associated with long periods of stagnant water.

For wet and extended wet detention Ponds, a water budget analysis shall be submitted for review. The water budget must demonstrate that the base flow to the pond is sufficient to ensure that water stagnation/algae matting will not become a problem.

**Wet and Extended Wet Detention Permanent Pool Sizing:** The permanent pool (or dead) storage volume is equivalent to twice the runoff volume generated by the Water Quality Design Storm.

**Soil Suitability:** Wet and extended wet detention Ponds are applicable in NRCS hydrologic soil group C and D soils. Dry Detention Ponds are applicable in NRCS hydrologic soil group B, C, and D soils. Sites with type A and B soils should consider the use of a rain garden.

**Setbacks:** Ponds shall be constructed to maintain the following setback distances from structures and other facilities. All distances are measured from the edge of the maximum water surface elevation. Minimum distance from the edge of the pond water surface to property lines and structure is 20 feet. Minimum distance from the toe of the pond berm embankment to the nearest property line is 5 feet.

Ponds shall be set back from surrounding slopes that exceed 10 percent as determined by a geotechnical analysis.

**Dimensions and Slopes:** Slopes and depth should be kept as mild as possible to avoid safety risks. Slopes within the pond shall not exceed 3 horizontal to 1 vertical.

The maximum depth of the pond shall not exceed 4 feet. The 0- to 2-foot depth shall be distributed evenly around the perimeter of the pond.

The distance between all inlets and the outlet shall be maximized to facilitate sedimentation. The minimum length-to-width ratio is 3:1, at the maximum water surface elevation. This ratio is critical to prevent “short-circuiting,” where water passes directly through the facility without being detained for any length of time. If area constraints make this ratio unworkable, baffles, islands, or peninsulas may be installed, with City approval, to increase the flow path and prevent short-circuiting.

Minimum freeboard shall be 1 foot above the highest potential water surface elevation (1 foot above the emergency overflow structure or spillway elevation).

Dry Detention Ponds shall be divided into a minimum of two cells. The first cell (forebay) shall contain approximately 10 percent of the design surface area and shall provide at least 0.5 foot of dead storage for sediment accumulation.

Wet and extended wet detention Ponds shall be divided into a minimum of two cells. The first cell (forebay) shall contain approximately 10 percent of the design surface area.

Flow Control for Extended Wet Detention and Dry Detention Ponds: To restrict flow rates exiting the pond a control structure must be used. For extended wet detention Ponds, this control structure must be located above the permanent pool elevation. The outlet orifice shall be designed to minimize clogging.

Weirs may be exposed and orifice structures must be enclosed in a catch basin, manhole, or vault and must be accessible for maintenance.

The control structure shall be designed to pass the flood control design storm event as overflow, without causing flooding of the contributing drainage area.

Outlet/Overflow: If a riser pipe outlet is used, it shall be protected by a trash rack and anti-vortex plate. If an orifice plate is used, it shall be protected with a trash rack with at least 10 square feet of open surface area. In both cases, the rack must be hinged or easily removable to allow for cleaning. The rack shall be adequately secured to prevent it from being removed or opened when maintenance is not occurring.

All Ponds shall have an emergency overflow spillway or structure designed to convey the flood control design storm for post-development site conditions, assuming the pond is full to the overflow spillway or structure crest. The overflow shall be designed to convey these extreme event peak flows around the berm structure for discharge into the downstream conveyance system. The overflow shall be designed and sited to protect the structural integrity of the berm.

The spillway shall be located to direct overflows safely toward the downstream conveyance system and shall be located in existing soil wherever feasible. The emergency overflow spillway shall be armored with riprap or other flow-resistant material that will protect the embankment and minimize erosion.

Berm Embankment and Soil Stabilization: Pond berm embankments shall be designed by a civil engineer licensed in the State of Oregon.

Pond berm embankments shall be constructed on native consolidated soil (or compacted and stable fill soil) that is free of loose surface soil materials, roots, and other organic debris. Topsoil is required over the consolidated soil to support required plantings. Berms may include a key if the engineering design warrants. Anti-seepage collars shall be placed on outflow pipes in berm embankments that impound water with hydraulic head pressure. The use of retaining walls in Ponds requires pre-approval from the City of Eugene.

Adequate flat top width of the berm is required to accommodate maintenance activities and equipment.

Fencing and Signage: Fencing and signage for private facilities shall be at the discretion of the facility owner.

Fences and signage for public facilities shall be required at the discretion of the City. The need for fencing a public facility is dependent on the existing site conditions and the proposed pond design.

### **Vegetation**

The planting design shall minimize solar exposure of open water areas. Trees or other appropriate vegetation shall be located around the facility to maximize shading. The emergent plant zone shall be at least 25 percent of the total pond water surface area. Site specific planting plans are required due to the specialized nature of ponds. An Oregon registered Landscape Architect shall prepare the landscape and planting plans for Ponds.

Growing Medium: Because pond grading generally requires the topsoil to be removed to form the basin shape of the pond, the resulting top layers of soil must to be amended, or topsoil must be imported for planting. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended to support plant growth.

### 2.3.9 Rain Garden

#### **Facility Description**

**Rain Gardens** are vegetated, flat bottomed, shallow landscape depressions used to collect and hold stormwater runoff. This allows pollutants to settle and filter out as water infiltrates into the ground. Rain gardens are water reservoirs to collect and treat stormwater runoff by allowing the pollutants to settle and filter out as the water percolates through vegetation and soil mediums before infiltrating into the ground below or being piped to its downstream destination. Rain gardens can also be sized to infiltrate the flood control design storm and are often used as complete on-site systems. Rain gardens can be configured in a number of different shapes making them very versatile for integrating into site and landscape plans



Rain Gardens can be used to help fulfill a site's required landscaping area requirement and should be integrated into the overall site design. Numerous design variations of shape and planting scheme can be used to fit the character of a site.

Rain Gardens qualify as infiltration and filtration facilities. Rain Gardens meet the stormwater management standards for water quality and flow control when designed under the Simplified Approach. Rain Gardens meet the stormwater management standards for water quality, flow control and flood control when designed under the Presumptive Approach.

#### **Design Requirements**

All facilities shall require an overflow to an approved discharge point unless sized to fully infiltrate the flood control storm.

**Sizing:** The Simplified Approach may be utilized for surface areas less than 15,000 square-foot of impervious area. Rain Gardens shall use a sizing factor of 0.05 for water quality using the Simplified Approach. Rain Gardens shall use a sizing factor of 0.11 for flow control with the Simplified Approach.

The Presumptive Approach shall be used for all other water quality, flow control and flood control designs in conjunction with a measured infiltration rate. Rain gardens shall be designed to pond water for less than 30 hours after each storm event.

Soil Suitability: Soils with infiltration rates greater than 2 in/hr shall be designed as infiltration treatment facilities. Soils with infiltration rates less than 2 in/hr shall be designed as filtration facilities.

Dimensions and Slopes: The facility storage depth must be at least 6 inches, unless the rain garden is horizontally sized larger than required. The facility storage depth shall be no more than 12 inches. Side slopes shall be a maximum of 3:1. The minimum bottom width shall be 2 feet. The bottom shall have no more than 0.5% slopes.

Setbacks: Rain Gardens located within 10-feet of building structures or 5 feet of property lines must be lined with an impermeable waterproof liner.

### **Materials**

Piping: Pipes shall be sized to convey design flow rates but shall be no less than 3 inches for private piping. Private piping shall conform to the requirement of the Uniform Plumbing Code. Sizing of public conveyance piping shall conform to the Public Improvement Design Standards Manual.

Drain Rock: Drain rock may be used below the growing medium of a Rain Garden. Drain rock can be used for retention, detention or conveyance. Drain rock shall be open graded, washed 3/4 inch to 2-1/2 inch diameter. Drain rock and growing medium must be separated by a geotextile.

Mulch: Washed pea gravel, river run rock or other non-floating mulch is recommended for Rain Gardens. It should be applied 2 – 3 inches thick to cover all solid areas between plants. It should not be over applied.

Waterproof Liners: The use of waterproof liners is discouraged as infiltration is encouraged on all facility types. Waterproofing liners may be required in areas where hydraulic isolation is required due to existing structural, hydrologic or geotechnical limitations. Rain Gardens located within 10 feet of building foundations or 5 feet of property lines must be lined with an impermeable membrane of 30 mil (minimum) plastic film or equivalent.

### **Vegetation**

The entire Rain Garden must maintain 90 percent coverage for vegetation. Vegetation shall conform to the facility planting list located in **Appendix D**.

Vegetated Rain Gardens shall be planted with minimum plant quantities from Schemes I, II or III. Minimum plant quantities for vegetated Rain Gardens are as follows:

<b>Vegetated Rain Garden Planting Scheme</b>	<b>I</b>	<b>II</b>	<b>III</b>
<b>Ground Cover</b> , 4-inch pots spaced 1' on center (per 100 square feet of the facility)	100	80	80
<b>Large Shrubs</b> , 3 gal. pots spaced 4' on center (per 100 square feet of the facility)		2	2
<b>Small Shrubs</b> , 1 gal. pots spaced 2' on center (per 100 square feet of the facility)		4	4
<b>Evergreen tree</b> , min. 6' height (per 200 square feet of the facility)		1	
<b>Deciduous tree</b> , 1-½ inch caliper (per 200 square feet of the facility)			1

Rain Gardens may elect to use grasses for side slopes. Grasses on side slopes must have 100 percent coverage at establishment by native grasses, turf grasses, native wildflower blends, native ground covers, or any combination thereof. Seed shall be applied at the rates specified by the supplier.

Vegetation or seed cover shall be established as soon as possible after the Rain Garden is completed, and before water is allowed to enter the facility. Unless vegetation or seed cover is established, biodegradable erosion control matting shall be installed in the flow area of the Swale before allowing water to flow through the Swale.

Growing Medium: The growing medium shall be a minimum 12 inches of topsoil or the soil shall be amended to support plant growth. Imported topsoil shall be a sandy loam mixed with compost or a sand/soil/compost blend. It shall be roughly one-third compost by volume, free-draining, and support plant growth. The compost shall be derived from plant material; animal waste is not allowed. In all cases, the growing medium shall be 12 inches deep.

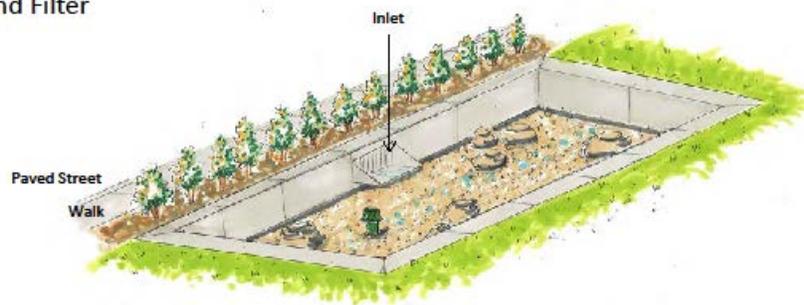
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### 2.3.10 Sand Filter

#### **Facility Description**

**Sand Filters** consist of a layer of sand in a structural box used to trap pollutants. The water filters through the sand and then infiltrates into the ground or has an underdrain system that conveys the filtered stormwater to a discharge point.

Sand Filter



Sand Filters qualify as infiltration and filtration facilities. Sand Filters meet the stormwater management standards for water quality and flow control when designed under the Simplified Approach. Sand Filters meet the stormwater management standards for water quality, flow control and flood control when designed under the Presumptive Approach.



#### **Design Requirements**

All facilities shall require an overflow to an approved discharge point unless sized to fully infiltrate the flood control storm.

**Sizing:** The Simplified Approach may be utilized for surface areas less than 15,000 square-foot of impervious area. Sand filters shall use a sizing factor of 0.03 for water quality with the Simplified Approach. Sand filters shall use a sizing factor of 0.07 for flow control with the Simplified Approach.

The Presumptive Approach shall be used for all other water quality, flow control and flood control designs in conjunction with a measured infiltration rate. Sand Filters shall be designed to pond water for less than 30 hours after each storm event.

**Soil Suitability:** Soils with infiltration rates greater than 2 in/hr shall be designed as infiltration treatment facilities. Soils with infiltration rates less than 2 in/hr shall be designed as filtration facilities.

**Dimensions and Slopes:** Facility storage depth must be at least 6 inches (from the inlet to the top of sand). The minimum Sand Filter width is 2 feet. Longitudinal slopes shall be less than 0.5%. Minimum freeboard of 2 inches shall be required for any overtopping event.

Public facility length to width ratio shall be 2:1 or greater. Minimum freeboard of 2 inches shall be required for any overtopping event.

Setbacks: Sand Filters require a setback from the property of 5 feet, unless the Sand Filter height is less than 30 inches. Required setback from building structures is 10 feet, unless the Sand Filter has a waterproof liner.

### **Materials**

Structural Walls: Private structural walls shall be made of stone, concrete, brick, or wood. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Public structural walls shall be made of concrete or segmented concrete blocks.

Geotextiles: Geotextile shall be used to separate drainage layers.

Inlet Structure: An inlet structure shall be provided to spread the flow of incoming water uniformly across the surface of the filter medium during all anticipated flow conditions. This flow shall be spread in a manner that prevents roiling or otherwise disturbing the filter medium.

Piping: Pipes shall be sized to convey design flow rates but shall be no less than 3 inches for private piping. Private piping shall conform to the requirements of the Uniform Plumbing Code. Sizing of public conveyance piping shall conform to the Public Improvement Design Standards Manual. Underdrain laterals shall be placed at no more than 10 foot spacing.

Filter Medium: Public filter bed medium shall consist of clean medium to fine sand with no organic material, or other deleterious materials and meeting the following gradation:

<b><u>Sieve Size</u></b>	<b><u>Percent Passing</u></b>
3/8 inch	100
#4	95-100
#8	80-100
#16	45-85
#30	15-60
#50	3-15
#100	< 4

### **Vegetation**

Plantings are optional in Sand Filters. For aesthetic purposes, potted plants may be submerged in the Sand Filter.

### 2.3.11 Stormwater Planter

#### **Facility Description**

#### **Stormwater Planters**

are walled vegetated surface reservoirs used to collect and treat stormwater runoff from impervious surfaces by allowing pollutants to settle and filter out as the water percolates through the vegetation and soil mediums before infiltrating into the ground below or being piped to its downstream destination.

Stormwater Planters can be used to help fulfill a site's required landscaping area requirement and should be integrated into the overall site design. Numerous design variations of shape and planting scheme can be used to fit the character of a site.

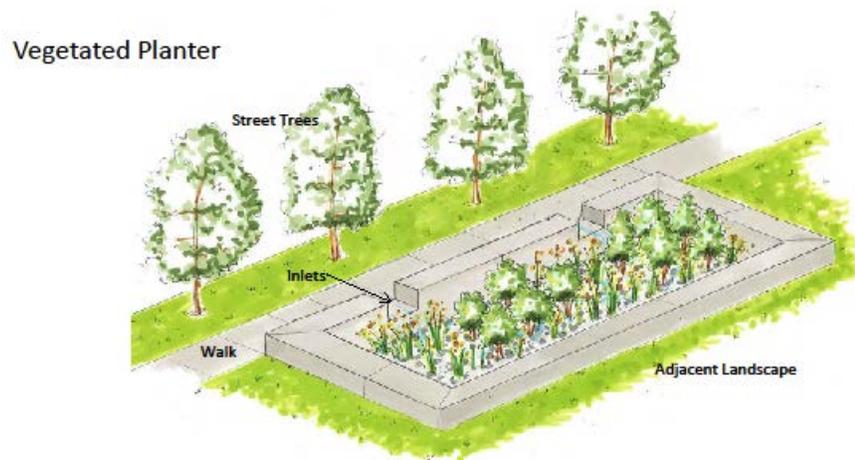
Stormwater Planters qualify as infiltration and filtration facilities. Stormwater Planters meet the stormwater management standards for water quality and flow control when designed under the Simplified Approach. Stormwater Planters meet the stormwater management standards for water quality, flow control and food control when designed under the Presumptive Approach.

#### **Design Requirements**

All facilities shall require an overflow to an approved discharge point unless sized to fully infiltrate the flood control storm.

**Sizing:** The Simplified Approach may be utilized for stormwater quality and flow control purposes for runoff from impervious surface areas less than 15,000 square-feet. Planters shall use a sizing factor of 0.03 for water quality with the Simplified Approach. Planters shall use a sizing factor of 0.07 for flow control with the Simplified Approach.

The Presumptive Approach shall be used for all other water quality, flow control and flood control designs in conjunction with a measured infiltration rate. Planters shall be designed to pond water for less than 30 hours after each storm event.



**Soil Suitability:** Soils with infiltration rates greater than 2 in/hr shall be designed as infiltration treatment facilities. Soils with infiltration rates less than 2 in/hr shall be designed as filtration facilities.

**Dimensions and Slopes:** Facility storage depth must be at least 6 inches (from inlet to top of growing medium); unless a larger-than-required planter square-footage is used. Maximum facility storage depth is 12". The minimum planter width is 24 inches (measured from inside of walls). Planters shall be constructed with no more than .5% slope.

For planters in the public right-of-way, all applicable City requirements for other street elements (curbs, sidewalks, trees, etc.) must be met. Planters located next to public sidewalks or curbs shall have a minimum 12 inch-wide flat area between the planter wall and the sidewalk or curb. Edge protection is required adjacent to bike and pedestrian facilities.

**Setbacks:** The required setback for infiltration planters is 5 feet from property lines and 10 feet from structures. Lined filtration planters do not require a setback with an approved waterproof liner. For planters that will be located abutting a structure, the planter shall have 30 inches of clearance from any electrical service panel/meter base and any point of overflow shall be located a minimum of 6 inches below any organic building material (siding).

### **Materials**

**Mulch:** Washed pea gravel, river run rock or other non-floating mulch is recommended for planters. It should be applied 2 – 3 inches thick to cover all exposed soil between plants. It should not be over applied.

**Planter Walls:** Private planter walls shall be made of stone, concrete, brick, wood, or other durable material. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Public planter walls shall be made of structural concrete, segmented retaining wall block or other material approved by the City of Eugene.

**Piping:** Pipes shall be sized to convey design flow rates per the uniform plumbing code but shall be no less than 3 inches for private piping. Sizing of public conveyance piping shall conform to the Public Improvement Design Standards Manual.

**Drain Rock:** Drain rock may be used below the growing medium of a planter. Drain rock can be used for retention, detention or conveyance. Drain rock shall be open graded washed 3/4 inch to 2-1/2 inch diameter open graded aggregate. Drain rock and growing medium must be separated by a geotextile.

**Waterproof Liners:** The use of waterproof liners is discouraged as infiltration is encouraged on all facility types. Waterproofing liners may be required in areas where hydraulic isolation is required due to existing structural, hydrologic or geotechnical limitations exist. Waterproof liners are required where planters are constructed within 10

feet of a building. The walls of a filtration Stormwater Planters can often be incorporated with the building foundation plans. The bottom of filtration Stormwater Planters located next to buildings must be lined with an impermeable membrane of 30 mil (minimum) plastic film or equivalent.

**Vegetation**

The entire Stormwater Planter must maintain 90 percent coverage by vegetation at establishment. Vegetation shall conform to the facility planting list located in **Appendix D**.

Vegetated stormwater planters shall be planted with minimum plant quantities from Schemes I, II or III. Minimum plant quantities for vegetated stormwater planters are as follows:

<b>Vegetated Stormwater Planter Planting Scheme</b>	<b>I</b>	<b>II</b>	<b>III</b>
<b>Ground Cover</b> , 4-inch pots spaced 1’ on center (per 100 square feet of the facility)	100	80	60
<b>Small Shrubs</b> , 1 gal. pots spaced 2’ on center (per 100 square feet of the facility)		4	12

Tree planting is not required in planters, but tree planting is encouraged near planters.

Vegetation shall be established as soon as possible after the planter is completed, and before water is allowed to enter the facility. Unless vegetation is established, biodegradable erosion control matting shall be installed in the flow area of the planter before allowing water to flow through the planter.

Growing Medium: The growing medium shall be a minimum 12 inches of topsoil or the soil shall be amended to support plant growth. Imported topsoil shall be a sandy loam mixed with compost or a sand/soil/compost blend. It shall be roughly one-third compost by volume, free-draining, and support plant growth. The compost shall be derived from plant material; animal waste is not allowed. In all cases, the growing medium shall be minimum 12 inches deep.

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### 2.3.12 Swale

#### Facility Description

**Swales** are long and narrow vegetated and grassed depressions used to collect, detain and convey stormwater runoff which allows pollutants to settle and filter out as the water flows through the facility. Swales can also be designed to manage flow rates and volumes when designed under the Presumptive Approach. Swales come in two general types, vegetated and grassy.

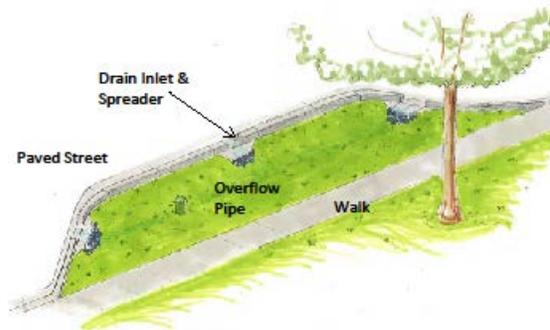
Swales can be used to help fulfill a site's required landscaping area requirement and should be integrated into the overall site design. Numerous design variations of shape and planting scheme can be used to fit the character of a site.

Swales qualify as filtration facilities. Swales meet the stormwater management standards for water quality when designed under the Simplified Approach. Swales meet the stormwater management standards for water quality, flow control and food control when designed under the Presumptive Approach.

Vegetated Swale



Grassy Swale



## **Design Requirements**

All facilities shall require an overflow to an approved discharge point unless sized to fully infiltrate the flood control storm.

Swales shall be designed as filtration facilities using volume rate based analysis. Swales can be used in conjunction with other facilities to meet multiple stormwater management standards.

**Sizing:** The Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. Swales shall use a sizing factor of 0.06 for water quality with the Simplified Approach.

The Presumptive Approach shall be used for all other stormwater quality, flow control and flood control facilities. Vegetative swales may account for infiltration rates when using the presumptive method.

The Swale width and profile shall be designed to convey runoff from the Water Quality Design Storm (intensity is 0.22 inches/hour for on-line facilities and 0.13 inches/hour for off-line facilities) and shall meet the following criteria:

- Maximum flow depth during the Water Quality Design Storm is 4 inches.
- Maximum water velocity during the Water Quality Design Storm is 0.9 feet per second.
- Minimum hydraulic residence time (time for  $Q_{\text{design}}$  to pass through the Swale) of 9 minutes.
- Minimum longitudinal slope of 0.5 percent, maximum slope of 6 percent. For slopes greater than 2 percent, check dams shall be used (one dam every 12 feet).
- Designed using a Manning "n" value of 0.25 for grassed Swales and 0.35 for vegetated Swales.

**Flood Control Criteria:** On-line stormwater quality swale facilities shall be designed to convey runoff from the Flood Control Design Storm and shall meet the following criteria:

- Maximum flow depth is 12 inches.
- Maximum water velocity through the facility shall not exceed 3 feet per second (fps) during the Flood Control Design Storm.

**Soil Suitability:** Swales are suitable for any soil types. Unless existing vegetated areas are approved as a swale, stormwater facility growing medium shall be used for the top 12 inches of the facility or the soil shall be amended to support plant growth.

**Dimensions and Slopes:** When designing swales, slopes and depth should be kept as mild as possible to avoid safety risks, improve aesthetics, and prevent erosion within the facility. Minimum Swale width shall be 5 feet and a maximum width of 12 feet. Maximum side slopes are 3 horizontal to 1 vertical for vegetated Swales, and 4 horizontal to 1 vertical for grassed Swales (to accommodate for mowing). Minimum flat bottom width is 2 feet. The

maximum bottom width is 8 feet. Maximum longitudinal slope is 6% and minimum slope is 0.5%. To minimize flow channelization, the Swale bottom shall be level, with a uniform longitudinal slope. Facility storage depth varies with layout and site constraints.

**Swales within Public Streets:** For Swales in the public right-of-way, all applicable City requirements for other street elements (curbs, sidewalks, trees, etc.) must be met. Swales located next to public sidewalks or curbs shall have a minimum 12 inch-wide flat area between the top of Swale slope and the sidewalk or curb.

**Setbacks:** The required setback from building foundations is 10 feet unless lined with a waterproof liner.

**Flow Inputs:** When the Simplified Method of sizing is used, the input or inputs into the Swale shall be at the upstream end and no other inputs (such as curb cuts or downspout connections) shall enter the Swale downstream.

**Check Dams:** Swales longer than 24 feet require that check dams be installed at 12-foot intervals along the length of the Swale. Check dams shall be constructed of durable, non-toxic materials such as rock, concrete, or soil may be used by integrating the design of the dams into the grading of the Swale. Check dams shall be 12 inches in length (as measured along the path of flow) by 4 to 10 inches in height. Check dams shall extend the complete width of the Swale; materials other than soil shall extend into the side slopes of the Swale for a minimum of 6 inches, so as to reduce the potential for erosion.

### **Materials**

**Mulch:** Washed pea gravel, river run rock or non-floating mulch is recommended for Swales. It should be applied 2 – 3 inches thick to cover all exposed soil between plants. It should not be over applied.

**Waterproof Liners:** The use of waterproof liners is discouraged as infiltration is encouraged on all facility types. Waterproofing liners may be required in areas where hydraulic isolation is necessary due to existing structural, hydrologic or geotechnical limitations exist. Swales located within 10 feet of building foundations must be lined with an impermeable membrane of 30 mil (minimum) plastic film or equivalent.

### **Vegetation**

The entire swale must maintain 90 percent coverage by vegetation or 100 percent coverage by grass at establishment. Vegetation shall conform to the facility planting list located in **Appendix D**.

Vegetated swales shall be planted with minimum plant quantities from Schemes I, II or III. Minimum plant quantities for vegetated swales are as follows:

<b>Vegetated Swale Planting Scheme</b>	<b>I</b>	<b>II</b>	<b>III</b>
<b>Ground Cover</b> , 4-inch pots spaced 1' on center (per 100 square feet of the facility)	100	80	80
<b>Large Shrubs</b> , 3 gal. pots spaced 4' on center (per 100 square feet of the facility)		2	2
<b>Small Shrubs</b> , 1 gal. pots spaced 2' on center (per 100 square feet of the facility)		4	4
<b>Evergreen tree</b> , min. 6' height (per 200 square feet of the facility)		1	
<b>Deciduous tree</b> , 1-½ inch caliper(per 200 square feet of the facility)			1

Grassy swales must have 100 percent coverage by native grasses, turf grasses, native wildflower blends, native ground covers, or any combination thereof. Seed shall be applied at the rates specified by the supplier.

Native grasses, and ground covers used for publicly maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for publicly maintained facilities; any exceptions will require City approval.

Vegetation or grass cover shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility. Unless vegetation or grass cover is established, biodegradable erosion control matting shall be installed in the flow area of the Swale before allowing water to flow through the Swale.

Trees:

Private Swales shall be planted with evergreen or deciduous trees and shall be planted within or adjacent to the Swale as follows:

<b>Swale Tree Planting Scheme</b>	
<b>Evergreen tree</b> , min. 6' height (planted 30' on center)	1
<b>Deciduous tree</b> , 1-½ inch caliper (planted 30' on center)	1

Trees within public rights of way are subject to the street tree ordinance.

Growing Medium: The growing medium shall be a minimum 12 inches of topsoil or the soil shall be amended to support plant growth. Imported topsoil shall be a sandy loam mixed with compost or a sand/soil/compost blend. It shall be roughly one-third compost by volume, free-draining, and support plant growth. The compost shall be derived from plant material; animal waste is not allowed. In all cases, the growing medium shall be 12 inches deep.

### 2.3.13 Proprietary Treatment Devices

#### **Facility Description**

The City of Eugene has developed a pre-approved list of proprietary treatment devices for private and public applications. The list is based upon the Washington Department of Ecology's Technology Assessment Protocol - Ecology (TAPE). The approved stormwater technologies are approved at the general use level for Basic or Pre-treatment. For the list of approved devices, see **Appendix E** of this manual.



Manufacturers wishing to submit technologies for approval shall submit those technologies to the Washington Department of Ecology (WashDOE). The City of Eugene does not test water quality treatment technologies. Proprietary treatment devices are approved for use within the City of Eugene based on WashDOE use level designations.

In addition, to be approved for use as a publicly maintained facility, the manufacturer must also submit detailed information about the facility's design criteria, construction techniques, operation and maintenance procedures, reliability, and cost to City of Eugene Public Works. This information will be reviewed by Public Works, which will decide whether or not the facility can be used for public projects.

Proprietary Treatment Devices meet the water quality standard for public facilities. Proprietary Treatment Devices qualify for a reduction of off-site stormwater quality management system development charges (if applicable) for private facilities.

#### **Design Criteria**

Proprietary treatment devices must be designed and constructed in accordance with the manufacturer's recommendations. Eugene may also place special design conditions on the acceptance of the technology based upon WashDOE criteria and local requirements, such as sizing requirements that go beyond the manufacturer's recommendations.

The proprietary treatment device must be certified to treat the water quality design storm and be able to bypass the Flood Control Design Storm if designed as an in-line facility. For off-line facilities a rainfall intensity of 0.13 in/hr must be used and for on-line facilities a rainfall intensity of 0.22 in/hr shall be used.

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### 2.3.14 Spill Control Manhole

#### **Spill Control Facility Description**

**Manholes** are specific to controlling oil releases. Spill control manholes are required for certain development or activities as defined in City Code EC 9.6794 and EC 9.6795. Spill control manholes rely on passive mechanisms that take advantage of oil being lighter than water. Oil floats to the surface and is periodically removed. Spill control manholes are simple underground manhole designs with a “T” outlet designed to trap small spills. Spill Control Manholes must be used in conjunction with other water quality systems to meet stormwater quality requirements.



Spill Control Manholes meet the stormwater management standard for flow control and source control.

There may be other acceptable oil controls. Proposals shall be reviewed and approved by the City of Eugene.

#### **Design Requirements**

Spill Control Manholes shall be used in conjunction with an appropriately sized stormwater quality facility. The spill control sump volume shall be 60 cubic feet or 20 cubic feet of sump capacity for each cubic feet per second (cfs) of peak water quality design flow, whichever is greater.

To maintain efficiencies and reduce size, all roof drainage should enter the stormwater system downstream of the Spill Control Manhole.

Any pumping devices shall be installed downstream of the Spill Control Manhole to prevent oil emulsification in stormwater.

Engineered flow calculations are required, using the Rational Method ( $Q=C*I*A$ ).

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### 2.3.15 Structural Detention Facility

#### Facility Description

**Structural Detention Facilities** are flow control devices. Structural detention facilities include tanks, vaults, and oversized pipes designed to fill with stormwater during large storm events and slowly release the runoff over a number of hours. There are numerous components to each system; inlet pipes conveying stormwater into the detention facility, detention chambers storing stormwater during storm events, and outlet drains restricting the flow out of the detention chamber.



As with any underground structure, they must be designed not only for their function as runoff flow control facilities, but also to withstand an environment of periodic inundation, potentially corrosive chemical or electrochemical soil conditions, and heavy ground and surface loadings. They must also be accessible for maintenance.

Structural Detention Facilities meet the stormwater management standard for flow control flood control.

#### Design Requirements

The following criteria apply to detention tank, vault, and oversized pipe design:

All facilities shall be located to allow easy maintenance and access. All areas of a tank or vault shall be within 50 feet of a minimum 36-inch diameter access entry cover. All access openings shall have round, solid locking lids.

Publicly maintained detention tanks, vaults, and pipes are permitted within public rights-of-way and dedicated public easements.

Minimum size for a public detention pipe shall be 36 inches. If the collection system piping is designed also to provide storage, the resulting maximum water surface elevation shall maintain a minimum 1-foot of freeboard in any catch basin below the catch basin grate. Pipe capacity shall be verified using an accepted methodology identified in Section 2.5.2. The minimum internal height of a vault or tank shall be 3 feet, and the minimum width shall be 3 feet. The maximum depth of the vault or tank invert shall be 20 feet.

Detention tanks and vaults shall have a minimum 6 inches of dead storage.

To restrict flow rates, a flow control structure must be used. Flow control structure calculation methods and examples are located in **Appendix F**.

Materials and Structural Stability: All tanks, vaults, and pipes shall meet structural requirements for overburden support and traffic loadings, if appropriate. H-20 live loads shall be accommodated for tanks and vaults under roadways and parking areas. End caps shall be designed for structural stability at maximum hydrostatic loading conditions. Construction joints shall be provided with water stops.

In soils where groundwater may induce flotation and buoyancy, measures shall be taken to counteract these forces. Ballasting with concrete or earth backfill, providing concrete anchors or other counteractive measures shall be required. Calculations shall be required to demonstrate stability.

Tanks and vaults shall be placed on stable, consolidated native soil with suitable bedding. Tanks and vaults shall not be allowed in fill slopes, unless a geotechnical analysis is performed for stability and construction practices.

### 2.3.16 Drywell

#### **Facility Description**

**Drywells** are structural subsurface facilities with perforated sides or bottom, used to inject stormwater runoff into the ground, recharging groundwater. Drywell systems consist of concrete or plastic manhole sections with many small holes in the sides to allow stormwater to exfiltrate into the surrounding soil.



The use of Drywells is highly dependent on soil type and height of the groundwater table.

Public drywells are not approved stormwater management facilities for runoff from public streets.

Drywells meet the stormwater management standard for flood control. The City of Eugene does not require pre-treatment before drywells since stormwater runoff is not discharged to the surface water system regulated under the MS4 Permit.

The Oregon Department of Environmental Quality (DEQ) has identified Drywells as “Class V Injection Wells” under the federal Underground Injection Control (UIC) Program. These facilities must be either authorized by rule or authorized by permit by DEQ. Since the UIC Program states that these types of wells can have a direct impact on groundwater, source controls and water quality facilities may be required prior to disposing stormwater into them. Designers shall design all underground injection systems to quality for DEQ Rule Authorization.

More information about the UIC Program can be found in **Section 1.6.5** or at DEQ's website at: <http://www.deq.state.or.us/wq/uic/uic.htm>. For technical questions call DEQ- UIC Program at 503-229-5696.

#### **Design Requirements**

**Sizing:** Drywells are recognized as flood control facilities for managing stormwater runoff. Drywells must be designed to accommodate the Flood Control Design Storm. The required drawdown time for sumps is 30 hours.

Roof runoff is generally exempt from water quality treatment when injected into a Drywell. A stormwater quality facility is not required if only roof water is injected into the Drywell and the Drywell has been rule authorized by the DEQ.

**Soil Suitability:** Soil conditions are critical to the success of Drywells. Drywells are optimally located in areas with infiltration rates exceeding 2 inches per hour but may be sized to accommodate lower infiltration rates. Drywells shall not be constructed in soils with infiltration rates less than 0.5 inches per hour. The bottom of the Drywell shall be at least 10 feet above the seasonal high water table.

Dimension and Slopes: Drywells shall not be constructed on slopes greater than 10%.

Setbacks: Drywells require 5 foot setbacks from the property lines and 10 foot setbacks from building foundations.

Number: More than one Drywell may be interconnected in series. Minimum distance between Drywells shall be 25 feet.

### **Materials**

Drywells shall be pre-cast concrete or manufactured plastics. Drywells shall meet structural requirements for overburden support and traffic loadings, if appropriate. H-20 live loads shall be accommodated for tanks and vaults under roadways and parking areas.

Piping: Pipes shall be sized to convey the flood control design storm.

Silt traps: Silt traps are strongly recommended on Drywell installations with no pre-treatment to extend the service life of the facility.

Covers: Drywells may have flat tops, manhole cones or other covers that are appropriately rated for surface loads. Drywells shall have an access cover at finished grade for maintenance and inspections.

Geotextile Fabric: Geotextile shall be required between the drainage rock and surrounding soils. Geotextile shall be required between the perforated sections of the sump and surrounding drainage rock if the size of perforations exceeds the diameter of drainage rock. Geotextile shall also be required to separate drainage layers if applicable.

Drainage Rock: Drainage rock shall be 3/4-inch to 2-1/2-inch open graded aggregate.

### 2.3.17 Soakage Trench

#### **Facility Description**

**Soakage trenches** are flood control devices injecting stormwater runoff into the ground recharging groundwater. Soakage trenches are linear excavations lined and backfilled with drain rock and gravel retaining runoff volumes as it exfiltrates into the surrounding soils. There are various components within the system – inlet piping, aggregate storage basin and perforated piping. The trench surface may be covered with grating, stone, sand, or a grassed cover with a surface inlet and may also be installed under hard surfaces such as driveways.



The use of Soakage Trenches is highly dependent on soil type and the height of the groundwater table. Public soakage trenches are not approved as stormwater management facilities for runoff from public streets.

Soakage Trenches meet the stormwater management standard for flood control. The City of Eugene does not require pre-treatment before drywells since stormwater runoff is not discharged to the surface water system regulated under the MS4 Permit.

DEQ has identified Soakage Trenches as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. These facilities must be classified as exempt, authorized by rule, or authorized by permit by DEQ. Since the UIC Program states that these types of wells can have a direct impact on groundwater, water quality treatment may be required before disposing stormwater into them. All Soakage Trenches must be registered with DEQ. Designers shall design all underground injection systems to quality for DEQ Rule Authorization.

More information about the UIC Program can be found in **Section 1.6.5** or at DEQ's website at: <http://www.deq.state.or.us/wq/uic/uic.htm>. For technical questions call DEQ- UIC Program at 503-229-5696.

#### **Design Requirements**

**Sizing:** Soakage Trenches shall be sized to infiltrate the Flood Control Design Storm. The maximum impervious area to be served by a soakage trench is 15,000 SF. Minimum drawdown time for soakage trenches is 30 hours.

**Dimension and Slopes:** Soakage Trenches shall not be constructed on slopes greater than 10%. Soakage trenches shall be laid level to retain uniform infiltration within the system. Trenches shall be a minimum 12" wide and the have a minimum 6" of cover from the drain rock or perforate pipe, whichever is higher) to finished grade.

**Soil Suitability:** Soil conditions are critical to the success of Soakage Trenches. Soakage Trenches are optimally located in areas with infiltration rates exceeding 2 inches per hour but may be sized to accommodate lower infiltration rates. Soakage trenches shall not be constructed in soils with infiltration rates less than 0.5 inches per hour.

**Setbacks:** Soakage Trenches require 5 foot setbacks from the property lines and 10 foot setbacks from building foundations.

**Trenches:** A silt basin, cleanout, or inspection port shall be required upstream of the trench for inspection purposes. There shall be no less than 5' of the infiltration medium and/or undisturbed soil between the bottom of the drain rock layer and any impervious layer (hard pan, bed rock, low permeability soils (0.5in/hr or less)). The bottom of the drain rock layer shall be no less than 5' above seasonally high groundwater.

### **Materials**

**Drain Rock:** The drain rock layer shall be no less than 12 inches. Drain rock shall be  $\frac{3}{4}$  inches to 2-1/2 inches washed open graded aggregate.

**Geotextile Fabric:** Soakage trenches shall be wrapped in geotextile fabrics. Geotextile shall be required between the drainage layers and surrounding soils. Geotextile shall also be required to separate drainage layers.

## 2.4 FACILITY SIZING APPROACHES

Facilities sized under the Simplified Approach and Presumptive Approach complies with the City of Eugene's Stormwater Flood Control, Stormwater Quality and Stormwater Flow Control requirements.

### 2.4.1 Simplified Approach (SIM Form 2013)

The Simplified Approach uses simple area ratio calculations to size stormwater facilities and is provided on the SIM Form 2013 located in **Appendix C**. The Simplified Approach may be used when the impervious surface area is less than 15,000 square feet (.34 acre), including but not limited to: roofs, patios, parking areas, and driveways. This approach is a relatively easy process for selecting and sizing stormwater quality and flow control facilities and is intended to save the project time and expense. The Simplified Approach is best used for small residential and commercial development. It is not intended to be used on large, complex projects with multiple catchments or challenging soils and topography. The Simplified Approach is not allowed for public improvement projects.

The Simplified Approach applies to surface vegetated facilities including:

- Filter Strips
- Rain Gardens
- Sand Filters
- Stormwater Planters
- Swales

Facilities may be sized using the Simplified Approach to comply either with sizing requirements for stormwater quality only or stormwater quality with flow control. Flood control sizing of facilities without an approved overflow must use the presumptive method with a measured infiltration rate. Infiltration testing standards are located in **Appendix G**. Projects with less than 2 inches per hour must use the sizing criteria in conjunction with underdrains and overflow to an approved point of discharge.

Generalized assumptions were used when developing the SIM Form that may result in conservative sizing for some development sites. Manual users have the option to use the sizing factors as given on the SIM Form or use the Presumptive Approach to calculate an alternative facility size.

### **SIM Form**

The **SIM Form 2013** is provided in **Appendix C**; enter impervious area reduction technique areas (Contained Planters, Eco roofs, Pervious Pavements, and Tree Credits) on the SIM Form before calculating the required stormwater quality facility size.

## **Simplified Approach Applications**

The minimum submittal requirements for the Simplified Approach are as follows:

- Site Plan
- Cross Section and Details
- Complete SIM Form
- Operations & Maintenance Packet (Chapter 3)
- Landscape Plan

### **2.4.2 Presumptive Approach**

Projects that use this design approach are presumed to be in compliance with the City's Stormwater Quality, Stormwater Flow Control, and/or Stormwater Flood Control requirements if the presented sizing and design requirements are followed.

The Presumptive Approach allows the designer to factor in site-specific data and analysis size and configure stormwater facilities. Infiltration testing and detailed hydrologic calculations must be performed to adequately size the facility to achieve the desired goal. The Presumptive Approach can be used to size infiltration and filtration treatment facilities as well as to design hybrid facilities and treatment trains. A maximum infiltration rate of 2.5 inches per hour shall be allowed for design of the growing medium.

The Presumptive Approach applies to surface infiltration and filtration treatment facilities including:

- Filter Strips
- Ponds
- Rain Gardens
- Sand Filters
- Stormwater Planters
- Swales

The Presumptive Approach applies to mechanical treatment facilities and spill control manholes.

The Presumptive Approach applies to subsurface facilities including:

- Structural Detention Facilities
- Drywells
- Soakage Trenches

### **Eugene Presumptive Calculator**

**Eugene's Presumptive Calculator** is an Excel spreadsheet available for applicants to use to determine the size of stormwater facilities under the Presumptive Approach. The spreadsheet may be downloaded from the City's stormwater web page.

### **Presumptive Approach Infiltration Testing**

The Presumptive Approach requires infiltration tests to be conducted before performing any design calculations. Three infiltration testing methods are available to determine the design infiltration rate:

- Open pit falling head
- Encased falling head
- Double-ring infiltrometer

A qualified professional must exercise judgment in the selection of the infiltration test method. Refer to **Appendix G** for the number and location of tests required. Depending on site conditions and the proposed facility location, the City may adjust the required number of tests. If the location and/or orientation of the proposed facility is revised during the design process, re-testing may be required.

The design professional may assume a maximum infiltration rate of 2 inches per hour, without testing, based upon the identification of mapped Type A and B soils unless sizing to infiltrate the Flood Control Event. Facilities sized to infiltrate the Flood Control Event without an overflow to an approved point of discharge are required to use an infiltration rate that is half the measured infiltration rate or the maximum design infiltration rate, whichever is smaller. All other facility infiltration may be designed at the measured infiltration rate.

### **Presumptive Approach Application**

The minimum submittal requirements for the Presumptive Approach are as follows:

- Scaled Site Plan
- Cross Section and Details
- Stormwater Analysis Report
- Operations & Maintenance Packet
- Landscape Plan

The stormwater report must be prepared by a licensed design professional. See **Appendix H** for submittal format and details.

## 2.5 HYDROLOGIC ANALYSIS

With the exception of facilities approved using the Simplified Approach, stormwater management facilities should be designed for stormwater quality, flow control and flood control using one of the hydrologic analysis methods described below. If one of the hydrologic analysis methods discussed below is not used, City staff must pre-approve the alternative method before the plans and calculations are submitted. Regardless of how the hydrologic calculations are performed, all hydrologic submittals shall include data necessary to facilitate the City's review.

**Flow Rate Based Facilities:** The Rational Method is the preferred analysis method for sizing flow rate based stormwater quality facilities. The following are flow rate based facilities:

- Swales
- Filter Strips
- Manufactured Treatment Devices
- Spill Control Manholes

**Flow Volume Based Facilities:** The design professional may use the Santa Barbara Urban Hydrograph (SBUH) Type 1A – 24 hour, NRCS TR-55, HEC-1, or SWMM design analyses for sizing volume based facilities. Volume based stormwater quality facilities included in this Manual are required to use the pre-determined volume of 1.4 inches over 24 hours with a  $V_b/V_r$  ratio of 2 to be in presumptive compliance with stormwater quality standards and 3.6 inches over 24 hours with flood control standards for a 10-year storm event (drainage basins less than 40 acres). Ponds are flow volume based facilities.

- Swales
- Rain Gardens
- Sand Filters
- Stormwater Planters

**Combination Rate/Volume Facilities:** Software design programs based on the SBUH Type 1A – 24 hour method, or a continuous simulation model with Eugene rainfall data, is the preferred analysis method for sizing of flow rate-based stormwater quality facilities that also rely on a storage volume component. When using SBUH, a 1.4 inch, 24-hour storm with NRCS type 1A rainfall distribution shall be used for stormwater quality design. When designing for flood control, the 5 year, 24 hour Flood Control Design Storm of 3.6 inches shall be used. The design professional may also use the NRCS TR-55, HEC-1, or SWMM.

- Swales
- Rain Gardens
- Sand Filters
- Stormwater Planters
- Soakage Trenches
- Drywells

## Conveyance

Conveyance channels and piping shall be sized in accordance with the methods identified in the Flood Control Design Storm Tables located in **Appendix K**

### Hydrologic Analysis Method Resources

The **Santa Barbara Urban Hydrograph (SBUH) Method** (see **Appendix M**) may be applied to small, medium, and large projects. It is a recommended method for completing the analysis necessary for designing flow control facilities when not using the Simplified Approach.

The **SCS TR-55 Method** may be applied to small, medium, and large projects. This is also one of the recommended methods for completing hydrologic analysis necessary for designing flow control facilities when not using the Simplified Approach. (Refer to SCS Publication 210-VI-TR-55, Most Current Edition.)

The **HEC-1 Method** may be used on medium and large projects. (Refer to the HEC User's Manual.)

The **SWMM Method** may be used on medium and large projects. (Refer to the SWMM User's Manual.)

## **2.6 ACCESS FOR OPERATIONS AND MAINTENANCE**

Adequate access for operations and maintenance must be provided to all stormwater management facilities and their components. Public facilities shall have access routes at least 10 feet wide, not to exceed 10 percent in slope, and shall be located adjacent to public rights-of-way wherever feasible. Access routes greater than 100 feet in length shall provide a vehicle turn-around for the maintenance vehicles. Where structural surfaces are needed to support maintenance vehicles, access routes shall be constructed of gravel or other permeable paving surface where possible. Public facility vehicular access routes shall be designed for H-20 loading.

## 2.7 OUTFALL DESIGN

Outfalls should be located above the downstream ordinary high water level, unless a pipe velocity of 3' per second can be maintained with the pipe outfall located below the water surface level. All outfalls shall be provided with a rock splash pad or other approved erosion control/energy dissipation measures. Rock protection at outfalls from small diameter pipes shall be as follows:

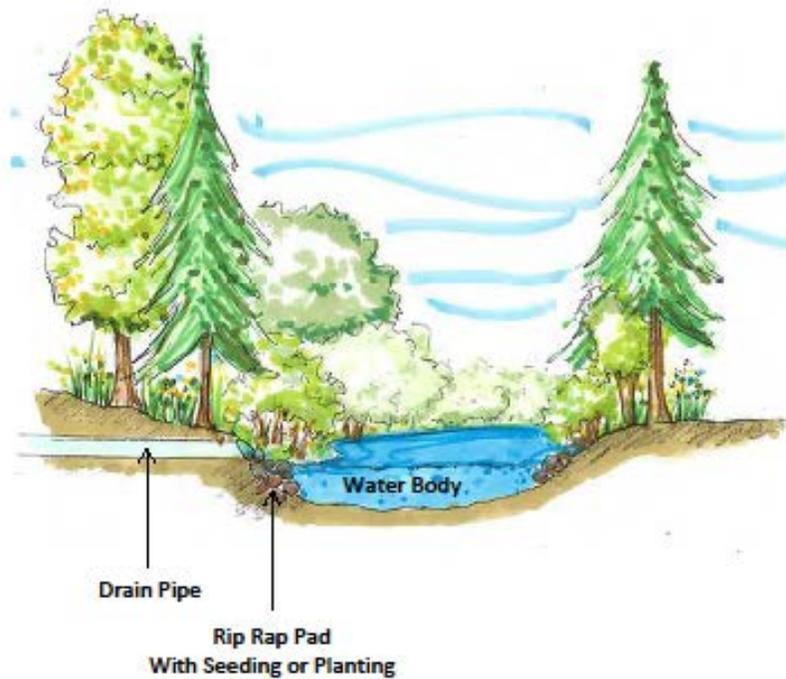
3" Pipe: 12" wide x 24" long x 2" deep, Average Stone Size = 1"

4" Pipe: 24" wide x 36" long x 4" deep, Average Stone Size = 2"

6" Pipe: 36" wide x 48" long x 6" deep, Average Stone Size = 4"

Rock protection at outfalls from pipes greater than 6 inches shall be engineered. Energy dissipation is required for flows greater than 20 fps. Design criteria for outfalls greater than 6" are located in **Appendix F**.

Drainage ways and rivers may have steep slopes or banks and may have unstable landforms. Engineering analyses may be required to determine the stability of the stream or river bank.



## **2.8 CONSTRUCTION CRITERIA**

This section provides general construction related requirements. Unless otherwise noted in the specific facility design criteria, compliance with the following construction criteria is required.

### **2.8.1 Public Stormwater Facilities**

Materials and construction of public facilities must be in compliance with the Eugene adopted Oregon Standard Specifications for Construction and Standard Drawings.

### **2.8.2 Site Preparation and Grading**

The location of all areas of future stormwater facilities should be clearly marked before site work begins. Infiltration and filtration treatment facilities areas should be fenced or covered to protect them from damage or misuse during construction and to prevent soil compaction during construction. No vehicular traffic, material storage, or heavy equipment are allowed within the infiltration treatment facility areas after site clearing and grading have been completed, except as needed to excavate, grade, and construct the facility. No stormwater facility areas should be used for dumping concrete, building materials, or other rubbish.

Existing vegetation to be saved must be clearly marked and securely protected. If native plants are present, they should be salvaged and stored for replanting once construction is complete. Unwanted vegetation in the facility area should be removed during site preparation with equipment appropriate for the type of material and site conditions.

Once the facility area is graded, all native subsoil must be tilled or ripped to a depth of 8" before installing the specified stormwater facility growing medium. No tilling should occur within the drip line of existing trees. After tilling is completed, no other construction traffic should be allowed in the facility area, except for planting and related work. All construction and other debris must be removed before the growing medium is placed.

Surface drainage must be prevented from entering the facility during construction until the facility is fully installed and the contributing catchment area is stabilized. The contractor is responsible for protecting the facility from erosion until fully stabilized.

### **2.8.3 Erosion and Sedimentation Plans**

Appropriate erosion control measures must be used to protect facilities from sedimentation. The erosion and sediment control plan (ESCP; may also be called construction site management plan, CSMP) set should show the fencing layout for vegetation to be protected and the location of stormwater facilities.

Location of all stockpiles must be indicated, including erosion protection measures per the City of Eugene's Erosion Prevention Ordinance.

### **2.8.4 Piping**

For private facilities, piping must be cast iron, ductile iron, concrete, ABS, PVC, HDPE, corrugated metals or other rigid pipe material. Three-inch pipe is required for facilities

draining up to 1,500 square feet of impervious area; otherwise 4-inch pipe minimum is required. Pipe sizing, slope and installations must follow current Uniform Plumbing Code.

For public facilities, all piping shall conform to The Public Improvement Design Standards (PIDS) Manual, City of Eugene Standard Specifications for Construction and standard drawings.

### **2.8.5 Gravel Drain Rock**

Drain rock may be required below the growing medium of a vegetated facility. Drain rock shall be washed open graded aggregate.

The required depth of the drain rock for facilities designed with the Simplified Approach is 12 inches. The depth of the drain rock varies with the Presumptive Approach. Depending on native infiltration rates and the amount of stormwater being routed to the facility, 12 inches to a maximum of 48 inches of drain rock may be specified.

Geotextiles shall be used to separate drain rock from native soils and the growing medium or sands. Geotextiles shall also be used to separate drainage layers with different gradations.

### **2.8.6 Geotextiles**

Geotextiles are often used in stormwater facilities. Non-woven fabrics make the best filters. Woven fabrics have greater strength and are less likely to clog. The design professional should specify the type of geotextile anywhere a geotextile is used.

## **2.9 LANDSCAPE REQUIREMENTS**

Eugene's stormwater management approach relies on the use of vegetated infiltration and filtration treatment facilities to comprehensively reduce runoff pollution and mitigate the volume, duration, time of concentration and rate of runoff. Stormwater quality facilities should be vegetated to the maximum extent feasible. Thriving vegetation is required in order to achieve compliance with the stormwater quality and flow control standards.

This section addresses the landscape requirements that apply to all vegetated stormwater facilities, both private and public. Vegetation planting schemes and growing medium criteria are provided with specific facility design criteria. These requirements are based on the City's experience and on standard design and construction methods in the landscape industry.

### **2.9.1 Relationship to Other Landscape Requirements**

When vegetated facilities are integrated into project landscape areas, they may also meet landscape standards set forth in Eugene Code Chapter 9. The benefits of integrated designs include construction cost savings, combined maintenance, aesthetic benefits, and the greater likelihood of maintaining long-term functionality.

Where the plant material requirements of this manual and Chapter 9 differ, the designer must use the most restrictive requirement. When calculating quantities, fractions should be rounded to the higher whole number. Landscaping required by Chapter 9 may be counted toward meeting the facility-specific landscape requirements in this chapter if the plantings are located within the facility area. An integrated design may require changing the size of some site elements.

### **2.9.2 Public Easement and Rights of Way Vegetation**

Rain gardens, swales and stormwater planters constructed in public right of way shall be grassed or vegetated with plants having a mature height of 24" or less. Stormwater treatment facilities do not remove street tree requirements for new street construction and should be located to allow planting street trees outside of the stormwater treatment facility where possible.

### **2.9.3 Growing Medium**

The depth of the growing medium is specified in the specific facility design criteria. Unless otherwise provided in the specific facility design criteria, compliance with the following growing medium requirements is required for landscaping.

For private facilities, the imported soil must be a sandy loam mixed with compost or a sand/soil/compost blend. It must be roughly one-third compost by volume, free-draining, and support plant growth. The compost must be derived from plant material; animal waste is not allowed.

For public facilities, growing medium is required as specified topsoil in the City of Eugene Standard Specifications for Construction.

Soil placement and planting should occur in conditions that do not result in over compaction or erosion. Temperature, moisture levels, and handling can have a significant influence on the infiltration rate of a facility and on plant survivability.

#### **2.9.4 Vegetation**

Plants are critical to the performance of vegetated stormwater facilities and therefore must be selected for the appropriate soil, hydrologic, and site-specific conditions. The planting design should minimize the need for herbicides, fertilizers, pesticides, or soil amendments at any time before, during, and after construction and on a long-term basis. Plantings should also be designed to minimize the need for mowing, pruning, and irrigation.

Plant species that have demonstrated their ability to withstand the “moist to wet” and “moist to dry” zones in stormwater facilities are provided in **Appendix D**. Applicants may select plants not shown on these lists, but are encouraged to research how successful the plants will survive in the planned stormwater facility.

Because portions of vegetated facilities areas are designed to accommodate inundation through the wet periods of the year, it is imperative for the designer to delineate the wet zone and develop a planting plan in accordance with the level of inundation/saturation. Stormwater facilities are expected to have a “moist to wet” zone that is saturated through most of the year along the bottom of the facility. The side slopes of the facilities are less frequently inundated and are delineated as the “moist to dry” zone within 18” of the bottom to the top of the facility slope. Planting plans must be specific to the designated zones.

Plants must be healthy and vigorous when planted. Within 2 years, the survival rate of vegetation must be sufficient to maintain minimum coverage requirements. If the survival rate falls below this threshold, additional plants sufficient to meet coverage requirements must be installed. The number of additional plants required should be based on the mortality rate of the initial planting.

Structural components such as chain link fence, concrete bulkheads, outfalls, riprap, gabions, large steel grates, pipe, blank retaining walls, vault lids, and access roads should be screened from view by vegetation. The quantities and spacing of plant material required for each facility should provide sufficient screening. Attention should be paid to site conditions that may require adjustments to the planting plan, including the need for additional trees and shrubs. The intent of this requirement is not to dictate a specific solution such as a linear hedge.

The planting plan must indicate the location of all landscape elements, including size, spacing, and species of all proposed plantings and existing plants and trees to be preserved. The plant list must include the botanical and common name, size at time of planting, quantity, type of container, evergreen or deciduous, and other information in accordance with the facility-specific planting section and landscape industry standards.

Depending on when stormwater will be routed to the facility, planting should preferably occur in the dormant season. For best results, planting should occur in the spring (March) or early fall (September through October).

### **2.9.5 Vegetation Coverage**

Facilities shall be fully vegetated and stabilized prior to water entering the facility. Following the establishment period, vegetated stormwater facilities must maintain 90% coverage to ensure stormwater treatment. All methods must have soils stabilized in accordance with the City of Eugene's Erosion Prevention Ordinance.

### **2.9.6 Grass Coverage**

Grass species must be sturdy, inundation and drought resistant, easy to establish and able to spread after establishment. A thick root structure is necessary to control weed growth and prevent erosion. Grasses shall have 100% coverage to ensure stormwater treatment.

Grass seed shall be applied at the rates specified by the suppliers. If plant establishment cannot be achieved with seeding prior to the completion of the project, the contractor shall at a minimum protect the facility against erosion by installing erosion blankets before water is allowed to enter the facility.

### **2.9.7 Mulch**

Non-floating bark, well-aged compost, washed pea gravel, river run rock or open graded rock up to 3" thick is recommended for most stormwater facilities. It should not be over-applied. Care should be given in the selection and placement of mulch material to avoid clogging inlets or outlets or otherwise escaping the facility.

At the time of final inspection, all surface area soils should be covered with plants and/or mulch sufficient to prevent erosion.

### **2.9.8 Irrigation**

Permanent irrigation systems are allowed for private facilities, but designers are encouraged to minimize the need for permanent irrigation. Innovative methods for watering vegetation are encouraged. Temporary irrigation systems for plant establishment are acceptable for public and private facilities. Permanent irrigation systems are not allowed for public facilities unless approved by the City of Eugene. Temporary irrigation systems or alternative methods of irrigation for landscape establishment should be specified when applicable.

### **2.9.9 Preventing Pollutants**

Projects must be designed to minimize the need for toxic or potentially polluting materials such as herbicides, pesticides, fertilizers, or petroleum-based fuels within the facility area before, during, and after construction. Mechanical means of weed control should be used where ever possible to reduce external pollutant loading.

Materials that could leach pollutants or pose a hazard to people and wildlife must not be used as components of a stormwater facility. Some examples of these materials are

chemically treated railroad ties and lumber and galvanized metals. Many alternatives to these materials are available.

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# Chapter 3.0

## ON-SITE SOURCE CONTROLS

This chapter presents on-site source controls required for site uses and characteristics that generate, or have the potential to generate, specific pollutants.

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## 3.1 INTRODUCTION

Some site characteristics and uses may generate specific pollutants that are not addressed solely through implementation of the stormwater quality measures identified in **Chapter 2.0**. The site characteristics and uses in this chapter have been identified as potential sources for chronic loadings or acute releases of pollutants such as oil and grease, toxic hydrocarbons, heavy metals, toxic compounds, solvents, abnormal pH levels, nutrients, organics, bacteria, chemicals, and suspended solids. This chapter presents source controls for managing these pollutants at their source.

Industrial facilities may be subject to additional requirements through State of Oregon issued NPDES permits or as outlined in Oregon Administrative Rules (OAR) 340 Division 041.

Eugene Code 6.340-6.380 lists prohibited discharges to the City's storm sewer system. The City has used these standards in the development of the listed source controls so stormwater discharges can better meet these criteria.

The implementation of this chapter is in addition to the applicable water quality, flow control, and flood control requirements.

Applicants may propose alternatives to the source controls identified in this chapter. Proposal of an alternative source control or alternative design element will require an additional review process and may delay issuance of related building or public works permits.

### 3.1.1 Site Uses and Characteristics That Trigger Source Controls

Projects with the following site uses and characteristics are subject to the design methodologies of this chapter:

- Fuel Dispensing Facilities and Surrounding Traffic Areas (**Section 3.2**)
- Above-Ground Storage of Liquid Materials (**Section 3.3**)
- Solid Waste Storage Areas, Containers, and Trash Compactors (**Section 3.4**)
- Outdoor Storage of Bulk Materials (**Section 3.5**)
- Material Transfer Areas/Loading Docks (**Section 3.6**)
- Equipment and/or Vehicle Washing Facilities (**Section 3.7**)
- Stormwater and Groundwater Management For Development On Land With Suspected or Known Contamination (**Section 3.8**)
- Covered Vehicle Parking Areas (**Section 3.9**)

Applicants are required to address all of the site characteristics and uses listed in **Sections 3.2** through **3.9**. For example, if a development includes both a fuel dispensing area and a vehicle washing facility, the source controls in both **Sections 3.2** and **3.7** will apply.

### 3.1.2 Source Control Goals and Objectives

The specific source control standards are based on the following goals and objectives:

- A) Prevent stormwater pollution by eliminating pathways that may introduce pollutants into stormwater.
- B) Protect soil, groundwater and surface water by capturing acute releases and reducing chronic contamination of the environment.

- C) Direct wastewater discharges (including wash water) to a wastewater destination that meets all applicable code requirements.
- D) Direct areas that have the potential for acute releases or accidental spills, and are not expected to regularly receive flow or require water use (such as covered fuel islands or covered containment areas), to an approved method of containment or destination.
- E) Safely contain spills on-site, avoiding preventable discharges to wastewater facilities, surface water bodies, or underground injection control structures (UICs).
- F) Emphasize structural controls over operational procedures. Structural controls are not operator dependent and are considered to provide more permanent and reliable source control. Any proposals for operation-based source controls need to describe the long-term viability of the maintenance program.

### 3.1.3 Signage

Informational signage is required for certain site uses and activities that may pollute stormwater. Signage addresses good housekeeping rules and provides emergency response measures in case of an accidental spill.

Required spill response supplies must be clearly marked, located where the signage is posted (or the location of the supplies must be clearly indicated by the signage), and must be located near the high-risk activity area. Required spill response supplies, such as absorbent material and protective clothing, should be available at all potential spill areas. Employees must be familiar with the site's operations and maintenance plan and proper spill cleanup procedures.

All signage shall conform to the standards described in the following box. Additional signage for specific activities is noted in applicable sections.

**Signs** shall be 8.5" x 11" or larger and located and plainly visible from all activity areas. More than one sign may be needed to accommodate larger activity areas. Signs shall be water-resistant and shall include the following information:

- Safety precautions for self-protection and spill containment.
- Immediate spill response procedures—for example: "Turn the valve located at..." or "Use absorbent materials"
- Emergency contact(s) and telephone number(s)—for example: "Call 911" and "City of Eugene Spill Response Number 541-682-4800"

### 3.1.4 Request for Alternative Design Method of Source Control

Applicants must notify the City's Public Works Department of their request in writing, specifying the reason for the request and supporting it with technical and factual data. Staff will check the supporting information submittal for completeness prior to review and decision. If the request cannot be satisfied with this process, the adjustment review process pursuant to EC 9.8030, will be implemented.

## **3.2 FUEL DISPENSING FACILITIES, EC 9.6795 (2)(a)**

**Fuel Dispensing Facilities** include areas where fuel is transferred from bulk storage tanks to vehicles, equipment, and/or mobile containers (including fuel islands, above ground fuel tanks, fuel pumps, and the surrounding pad). This applies to large-sized gas stations as well as single-pump fueling operations.

### **3.2.1 Cover**

The fuel dispensing area shall be covered with a permanent canopy, roof, or awning so precipitation cannot come in contact with the fueling activity areas. Rainfall shall be directed from the cover to an approved stormwater destination.

**Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated fueling activity area/pad it is to cover.

**Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated fueling activity area/pad it is to cover.

### **3.2.2 Pavement**

A paved fueling pad shall be placed under and around the fueling activity area with asphalt or concrete and shall meet all applicable building code requirements. Sizing of the paved areas shall be adequate to cover the activity area, including placement and number of the vehicles or pieces of equipment to be fueled by each pump.

Fuel pumps shall be located a minimum of seven feet from the edge of the fueling pad.

### **3.2.3 Drainage**

The paved area beneath the cover shall be hydraulically isolated through grading, berms, or drains. This will prevent uncontaminated stormwater from running onto the area and carrying pollutants away. Drainage from the hydraulically isolated area shall be directed to an approved City wastewater system, or authorized pretreatment facility. Surrounding runoff shall be directed away from the hydraulically isolated fueling pad to a stormwater destination that meet all stormwater management practices of this manual and other applicable code requirements.

### **3.2.4 Signage**

Signage shall be provided at the fuel dispensing area and shall be plainly visible from all fueling activity areas. Signage must clearly specify the location of any applicable spill control kits, shut-off valves, etc. and include all necessary instructions for their use.

### **3.2.5 Spill Control Manhole**

A spill control manhole shall be installed on the discharge line of the fueling pad (before the domestic waste line tie-in). The tee section shall extend 18 inches below the outlet elevation, with an additional 3 feet of dead storage volume below the tee to provide storage for oil and grease. The total containment volume shall be no less than 110% the volume of the largest container or 10% of the total volume of product stored, whichever is larger. The manhole shall be located on private property.

### 3.2.6 Shut-Off Valves

**A) Shut-off valves** are required to protect the City sewer systems or onsite infiltration facilities of spill risks from chemicals and other constituents that provide a danger for wide spread contamination, system damages or risk to the public health. Manual shut-off valves shall not be permitted unless a request for an adjustment is approved by the City.

Shut-off valves will be required in the following situations:

- Site or activity areas where corrosives or oxidizers are used or stored (for example, concentrated acids are corrosives having a pH of less than or equal to 5.0 and bases such as sodium or ammonium hydroxide having a pH of greater than or equal to 12.0, common oxidizers are hydrogen peroxide and bleach); or
- Substances which are water soluble or float on water; or
- Solvents and petroleum products

**B) Traffic pathways that surround the fueling pad, also designated as high-use/high-risk areas, will require a shut-off valve on the storm drainage system.** Valves installed on storm drainage systems shall be installed downstream of all private stormwater quality facilities to accommodate spill containment. These valves should be left open to facilitate stormwater flows during normal conditions, and immediately closed in the event of a spill. The switch or handle to operate the shut-off valve must be clearly marked and accessible, and identified on the signage at the fuel dispensing area. In the event of a spill the valve must remain closed until all spilled fuel and residue has been properly removed and disposed of.

**C) Fueling pads will require a shut-off valve downstream of the spill control manhole.** Valves installed on wastewater systems shall be installed before the domestic waste line tie-in. These valves must automatically revert to the closed position. These valves must be kept closed, and opened only to allow incidental drainage activities that do not pose to be a threat or risk to the destination system.

**D)** Shut-off valves shall be located on private property and downstream of the exposed area's collection system. All valves shall be installed and maintained as per manufacturer's recommendations. For more information about shut-off valves and associated valve boxes, contact Building & Permit Services at 541-682-5086.

### 3.2.7 Additional Requirements

**A) Installation, alteration, or removal of above-ground fuel tanks larger than 55 gallons, and any related equipment,** are subject to additional permitting requirements by the Eugene Fire Marshal's Office. For technical questions and permitting, call the Fire Marshal's Office Permit Center at 541-682-5411, or visit them at Permit & Information Center, 99 W. 10<sup>th</sup> Avenue, Eugene, OR 97401.

**B) Bulk fuel terminals,** also known as tank farms, will require the following:

- Secondary containment equal to 110 percent of the product's largest container or 10 percent of the total volume of product stored, whichever is larger.

- A separate containment area for all valves, pumps and coupling areas with sub-bermed areas either in front of or inside the main containment areas. These sub-bermed areas are required to have rain shields and be directed to a City wastewater destination that meets all applicable code requirements if no City wastewater facility is available, drainage shall be directed to a temporary holding facility for proper disposal.
- An impervious floor within all containment areas. Floors must be sealed to prevent spills from contaminating the groundwater.
- Truck loading and off-loading areas. These areas shall follow cover, pavement, drainage, spill control, and shut-off valve requirements identified for fuel dispensing facilities.
- Shut-off valves installed for the drainage of the tank yard, shall be installed downstream of the drainage system of the primary containment area, and kept closed. Valves installed for the drainage of the truck pad and sub-bermed containment areas shall be installed on the wastewater line downstream of the spill control manhole.
- A batch discharge authorization before draining a containment area. This authorization will determine appropriate disposal methods, identify pretreatment requirements (if applicable), and authorize the discharge. Pretreatment may be required for oil and grease removal, and testing may be required to establish the specific characteristics of the discharge.

**C) Underground fuel tanks less than 4,000 gallons** in size are subject to additional permitting requirements by Oregon's Department of Environmental Quality (DEQ) and tanks larger than 4,000 gallons are referred to the Federal Environmental Protection Agency (EPA). For technical questions and permitting, call DEQ's NW Region main office at 1-800-844-8467 and ask for the Underground Storage Tank Permitting Department.

### 3.3 ABOVE-GROUND STORAGE OF LIQUID MATERIALS, EC 9.6795 (2)(b)

*Above-Ground Storage of Liquid Materials* include places where exterior storage (either permanent or temporary) of liquid chemicals, food products, waste oils, solvents, or petroleum products in above-ground containers, in quantities of 50 gallons or more exist.

#### 3.3.1 Containment

Liquid materials shall be stored and contained in such a manner that if the container(s) is ruptured, the contents will not discharge, flow, or be washed into a receiving system. A containment device and/or structure for accidental spills shall have enough capacity to capture a minimum of 110 percent of the product's largest container or 10 percent of the total volume of product stored, whichever is larger.

Containers, such as double-walled containers, with internal protection are considered to meet this requirement.

#### 3.3.2 Cover

**Storage containers (other than tanks)** shall be completely covered to prevent stormwater contact. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

**Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

**Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

#### 3.3.3 Pavement

All above ground storage of liquid material must occur in paved areas. The storage area shall be paved with asphalt or concrete and shall meet all applicable building code requirements. Sizing of the paved areas shall be adequate to cover the area intended for storage.

#### 3.3.4 Drainage

All paved storage areas shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater run-on to a storage area.

**Covered storage areas:** Significant amounts of precipitation are not expected to accumulate in covered storage areas, and drainage facilities are not required for the contained area beneath the cover. If the applicant elects to install drainage facilities, the drainage from the hydraulically isolated area shall be directed to a wastewater destination that meets all applicable code criteria.

**Uncovered storage areas with containment:** Water will accumulate in uncovered storage areas during and after rain. Any *contaminated* water cannot simply be drained from the area. It must be collected, inspected, and tested at the expense of the property owner

before proper disposal can be determined. Some type of monitoring may also be needed to determine the characteristics and level of contamination of the stormwater.

All discharges to the wastewater system shall be considered batch discharges and shall require approval and meet applicable code requirements. Pretreatment requirements shall be set as part of the discharge approval process, based on the types and quantities of material to be discharged. A discharge evaluation shall be performed before connection to a wastewater facility. Testing may be required to establish characteristics of the wastewater or contaminated stormwater and to verify that local discharge limits are not exceeded. For batch discharge applications, call Public Works staff at 541-682-8600.

### **3.3.5 Signage**

Signage shall be provided at the liquid storage area and shall be plainly visible from all surrounding activity areas.

### 3.4 SOLID WASTE STORAGE, EC 9.6795 (2)(c)

**Solid Waste Storage Areas, Containers, and Trash Compactors** include outdoor areas with one or more facilities that store solid waste (both food and non-food waste) containers. One- and two-family residential solid waste storage areas, containers, and trash compactors are exempt from this code subsection.

Solid waste includes both food and non-food waste or recycling. Solid waste containers include compactors, dumpsters, compost bins, grease bins, recycling areas, and garbage cans. Debris collection areas used only for the storage of wood pallets or cardboard is excluded from these requirements.

The following site uses and activities include all commercial and industrial development with facilities that store solid wastes, both food and non-food.

- Outdoor solid waste storage areas.
- Multi-family residential sites if a shared trash collection area is proposed.
- Activity areas used to collect and store refuse or recyclable materials, such as can or bottle return stations and debris collection areas.
- Facilities whose business is to process and/or recycle wood pallets or cardboard.

#### 3.4.1 Design

For approval of solid waste storage and handling activity areas in the City of Eugene, the following design requirements will apply. See below for a clarification of each requirement:

ACTIVITY/ USE	REQUIREMENTS			
	(1) Cover	(2) Pavement	(3) Isolated	(4) Wastewater Drain
Multi-residential (with shared trash areas)	X	X	X	X*
Commercial	X	X	X	X
Industrial	X	X	X	X
Compactors (regardless of use)	X	X	X	X
Can and bottle return stations	X	X	X	X

\* Multi-residential ONLY. In the event gravity service to the wastewater lines cannot be obtained, a request can be made to direct the drainage from the hydraulically isolated activity area to the development's stormwater quality facility. For more information, refer to Additional Requirements below.

#### 3.4.2 Cover

A permanent canopy, roof, or awning must be provided to cover the solid waste storage activity area and shall be constructed to cover the activity area so rainfall cannot come in contact with the waste materials being stored. The cover shall be sized relative to the perimeter of the hydraulically isolated activity area it is to cover. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

### 3.5 OUTDOOR STORAGE OF BULK MATERIALS, EC 9.6795 (2)(d)

Any bulk materials storage location that is not completely enclosed by a roof and sidewalls is an outdoor storage area.

#### 3.5.1 Bulk Materials Categories

Bulk materials are separated into three categories based on risk assessments for each material stored: high-risk, low-risk, and exempt.

High-Risk Materials	Low-Risk Materials	Exempt Materials
<ul style="list-style-type: none"> <li>• Recycling materials with potential effluent</li> <li>• Corrosive materials (<i>e.g.</i> lead-acid batteries)</li> <li>• Storage and processing of food items</li> <li>• Chalk/gypsum products</li> <li>• Feedstock/grain</li> <li>• Material by-products with potential effluent</li> <li>• Asphalt</li> <li>• Fertilizer</li> <li>• Pesticides</li> <li>• Lime/lye/soda ash</li> <li>• Animal/human wastes</li> <li>• Treated Lumber</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling materials without potential effluent</li> <li>• Scrap or salvage goods</li> <li>• Metal</li> <li>• Sawdust/bark chips</li> <li>• Sand/dirt/soil (including contaminated soil piles)</li> <li>• Material by-products without potential effluent</li> <li>• Unwashed gravel/rock</li> <li>• Composting Operations</li> </ul>	<ul style="list-style-type: none"> <li>• Washed gravel/rock</li> <li>• Finished lumber</li> <li>• Plastic products (hoses, gaskets, pipe, <i>etc.</i>)</li> <li>• Clean concrete products (blocks, pipe, <i>etc.</i>)</li> <li>• Glass products (new, non-recycled)</li> </ul>

#### 3.5.2 Cover

**Low-risk** materials must be covered with a temporary plastic film or sheeting at a minimum.

**High-risk** materials are required to be permanently covered with a canopy or roof to prevent stormwater contact and minimize the quantity of rainfall entering the storage area. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

**Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

**Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

#### 3.5.3 Pavement

**Low-risk** material storage areas are not required to be paved.

**High-risk** material storage areas shall be paved beneath the structural cover.

### 3.5.4 Drainage

**Low-risk** material storage areas are allowed in areas served by standard stormwater management systems. However, all erodible materials being stored must be protected from rainfall.

If materials are erodible, a structural containment barrier shall be placed on at least three sides of every stockpile to act as a barrier to prevent uncontaminated stormwater from running onto the storage area and carrying pollutants away. If the area under the stockpile is paved, the barrier can be constructed of asphalt berms, concrete curbing, or retaining walls. If the area under the stockpile is unpaved, sunken retaining walls or ecology blocks can be used. The applicant shall clearly identify the method of containment on the building plans.

For **high-risk** material storage areas, the paved area beneath the structural cover shall be hydraulically isolated through grading, structural containment berms or walls, or perimeter drains to prevent runoff. . Significant amounts of precipitation are not expected to accumulate in covered storage areas, and drainage facilities are not required for the containment area beneath the cover. If the applicant elects to install drainage facilities, the drainage from the hydraulically isolated area shall be directed to the City's wastewater facility (with approval from the Wastewater division) and shall meet all applicable code criteria.

### 3.5.5 Additional Requirements

- A) **Storage of pesticides and fertilizers** may need to comply with specific regulations outlined by the Oregon Department of Environmental Quality (DEQ). For answers to technical questions, call DEQ's NW Region main office at 1-800-844-8467.
- B) **A sampling manhole** or other suitable stormwater monitoring access point may be required to monitor stormwater runoff from the storage area. This may apply to certain types of storage activities and materials or if an alternative source control is proposed. This requirement complies with Eugene Code, which requires appropriate stormwater destination. PW staff will review for applicability of this requirement.
- C) **Signage** shall be provided at the storage area if hazardous materials or other materials of concern are stored. Signage shall be located so it is plainly visible from all storage activity areas. More than one sign may be needed to accommodate large storage areas.
- D) If the applicant elects to install drainage facilities to the City's wastewater facility, a **shut-off valve** may be required for the structurally covered storage area. Eugene will make this determination based on the type of material stored and the proposed system receiving the discharge.

### 3.5.6 Alternative Protection Measures

In lieu of covering mineral resource mining, recovery, stockpiling, and processing operations and low-risk material storage areas receiving land use approval, the applicant may propose alternative protection measures that demonstrate that stormwater runoff from the site will not contaminate adjoining properties, surface waters, and ground water as part of their land use application.

## 3.6 MATERIAL TRANSFER AREAS/LOADING DOCKS, EC 9.6795 (2)(e)

**Material Transfer Areas/Loading Docks** include areas that are either interior or exterior to a building, designed to accommodate a commercial truck/trailer being backed up to or into them, and used specifically to receive or distribute materials to and/or from commercial trucks/trailers. Includes loading/unloading facilities with docks, and large bay doors without docks.

These requirements also apply to all development proposing the installation of new material transfer areas or structural alterations to existing material transfer areas (*e.g.*, access ramp regrading, leveler installations) with the following characteristics:

- The area is designed (size, width, *etc.*) to accommodate a **commercial truck (1 ton and larger)** or trailer being backed up to or into it; and,
- The area is design so that it can be used to receive or distribute materials to and from trucks or trailers.

Two standard types of **material transfer areas** associated with buildings are:

- Loading/unloading facilities with docks
- Large bay doors without docks

Pursuant to EC 9.6795(3), the requirements in this section do not apply to material transfer areas or loading docks used only for mid-sized to small-sized passenger vehicles and areas restricted by lease agreements or other regulatory requirements to storing, transporting or using materials that are classified as domestic use, for example, primary educational facilities (elementary, middle or high schools), or buildings used for temporary storage, and churches.

### 3.6.1 Cover

**The hydraulically isolated areas in front of loading docks** are required to be permanently covered with a canopy or roof to prevent stormwater contact and to minimize the quantity of rainfall entering the loading dock area. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

**Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

**Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

### 3.6.2 Pavement

A paved material transfer area shall be placed underneath and around the loading and unloading activity area with asphalt or concrete that meets all applicable building code requirements. This will reduce the potential for soil contamination with potential impacts on groundwater and will help control any acute or chronic release of materials present in these areas.

### 3.6.3 Drainage

**Loading Docks:** Drainage from the hydraulically isolated area shall be directed to a wastewater destination that meets all applicable code requirements. Surrounding runoff

and drainage from the access ramp shall be directed away from the hydraulically isolated area to a stormwater destination that meets all applicable requirements of this manual.

The requirement for the drainage from the hydraulically isolated area of the loading dock to be directed to the City's wastewater facility, or authorized pretreatment facility may be waived if PW determines there is no gravity wastewater service available and an appropriately sized, underground temporary storage structure (such as a catch basin with no outlet or dead-end sump) is provided.

#### Non-Gravity Option

Activity areas that cannot achieve gravity wastewater service may be allowed to install a pressurized system. These types of installations will require the following to be provided at the time of building permit application:

- 1) Proof that gravity wastewater service cannot be obtained; and
- 2) Details of an electronic sump pump system equipped with a float switch

Pressurized system installations are considered "permanent equipment" and deemed the property owner's liability in the event of system failure or if the property becomes vacated.

The Building & Permit Services will review all sump pump or sewage ejector installations for compliance with Uniform Plumbing Code and Oregon State Plumbing Specialty Code. The City will review for compliance with this chapter of the Stormwater Management Manual.

**Bay Doors and Other Interior Transfer Areas:** Because interior material transfer areas are not expected to accumulate precipitation, installation of floor drains is not required or recommended. It is preferable to handle these areas with a dry-mop or absorbent material. If interior floor drains are installed, they shall be plumbed to the City's wastewater facility or authorized pretreatment facility. Interior transfer areas may not be sloped to drain to the exterior of the building.

#### **3.6.4 Isolation**

**Loading Docks:** The first three feet of the paved area, measured from the building or dock face, shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater from running onto the area and carrying pollutants away.

**Bay Doors and Other Interior Transfer Areas:** Bay doors and other interior transfer areas shall be designed so that stormwater runoff does not enter the building. This can be accomplished by grading or drains. Interior surfaces may not drain or be washed down to the exterior of the building.

#### **3.6.5 Signage**

Signage shall be provided at the material transfer area and shall be plainly visible from all surrounding activity areas.

#### **3.6.6 Additional Requirements**

- A) **Bay doors and other interior transfer areas** shall provide a 10-foot "no obstruction zone" beyond the entrance within the building. This will allow the transfer of materials to occur with the truck or trailer end placed at least 5 feet inside the building, with an additional staging area of 5 feet beyond that. The "no

obstruction” zone shall be clearly identified on the stormwater management plan and on the building plan at the time of the building permit application. The area shall be identified at the facility by painting the “no obstruction zone” with bright or fluorescent floor paint.

**B) Shut-off valves will be required under the following situations:**

- 1) Site activity areas that are exposed to corrosives or oxidizers that can harm conveyance system components (such as battery acid).
- 2) Substances that do not settle or remain in one location, but are capable of being dissolved in or float on top of water (such as oil and grease). These substances can spread rapidly into downstream systems, causing widespread impacts and difficult clean-up situations.
- 3) Substances that are known to infiltrate through soils and contaminate groundwater.

Valves located in material transfer areas are typically left open to facilitate drainage during normal conditions, and immediately closed in the event of a spill.

Prior to transfer activities of harmful substances, the valves should be closed and only re-opened after the transfer is complete. The shut-off valves must be located on private property and downstream of the exposed area’s collection system.

All valves shall be installed and maintained in accordance with manufacturer specifications. For more information about shut-off valves and associated valve boxes, contact the Building & Permit Services at 541-682-5086.

## 3.7 EQUIPMENT AND/OR VEHICLE WASHING FACILITIES, EC 9.6795 (2)(f)

*Equipment and/or Vehicle Washing Facilities* include designated equipment and/or vehicle washing or steam cleaning areas, including smaller activity areas such as wheel washing stations.

### 3.7.1 Cover

The washing area shall be covered with a permanent canopy or roof so precipitation cannot come in contact with the washing activity area. Precipitation shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

**Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated washing activity area it is to cover.

**Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated washing activity area it is to cover.

### 3.7.2 Pavement

A paved wash pad shall be placed under and around the washing activity area with asphalt or concrete that meets all applicable building code requirements. Sizing of the paved area shall adequately cover the activity area, including the placement of the vehicle or piece of equipment to be cleaned.

### 3.7.3 Drainage

The paved area beneath the cover shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater from running onto the area and carrying pollutants away. Drainage from the hydraulically isolated area shall be directed to the City's wastewater facility, or authorized pretreatment facility. Surrounding runoff shall be directed away from the hydraulically isolated washing pad to a stormwater destination that meets all applicable requirements of this manual.

### 3.7.4 Oil Control

All vehicle and equipment washing activities will be reviewed for needed oil controls to comply with the City's wastewater discharge limits. The following design criteria are established for oil/water separators discharging to a wastewater facility:

#### A) Washing Areas Protected with a Cover or Located Inside a Structure

- 1) Baffled oil/water separators and spill control (SC-Type) separators shall not be allowed for use with equipment and/or vehicle washing applications. *Note: activities and processes of a washing facility change over time and the introduction of heat and surfactants may occur.*
- 2) Coalescing plate separators shall be designed to achieve 100 ppm non-polar oil and grease in the effluent from the peak flow generated by the washing activity. Testing information must be submitted by the manufacturer of the unit that supports the 100 ppm effluent standard at the calculated flow rate.
  - a. Standard flow from a 5/8" hose is estimated to be 10 gpm.

- b. For specially designed washing units, check the vendor specifications for maximum flow rates.
- 3) Any pumping devices shall be installed downstream of the separator to prevent oil emulsification.
- 4) Separator details must be shown on the building plans submitted for permit, and shall match manufacturer specifications and details, including the unit flow rate, effluent water quality, and maximum process flow rate.

**B) On-site Wash Recycling Systems**

Wash recycling systems may be used for oil control as long as they can meet effluent discharge limits for the City's wastewater system. A detail of the wash recycling system and vendor specifications identifying effluent efficiencies shall be submitted as part of the building plans at the time of building permit application.

## **3.8 LAND WITH SUSPECTED OR KNOWN CONTAMINATION, EC 9.6795 (2)(g)**

### **3.8.1 Review and Permit Process**

In addition to local, state, and federal regulations requiring special handling and management of contaminated site soils, a review of groundwater and surface drainage may be necessary. As a result of these regulations, sites with suspected or known contamination will require a more detailed review process and may delay issuance of related building permits.

To research contaminant information, parties should refer to DEQ's Facility Profiler database, which can be found at: <http://deq12.deq.state.or.us/FP20/StartPage.aspx>

**If records indicate that a No Further Action (NFA) or a Record of Decision (ROD) exist for your site, you must contact DEQ prior to pre- and post-construction activities to ensure conditions of record are not violated. For technical questions related to site contamination and clean-up, contact the Land Quality Division of DEQ.**

**All regulatory Divisions or Departments of DEQ, as referenced in this section, can be reached by calling DEQ's Western Region Office at 1-800-844-8467.**

**Note: Even if DEQ does not have a site included in its tracking database, this does not mean that contamination may not be present.** At a minimum, if commercial or industrial history exists, a Phase I site assessment shall be performed prior to design.

### **3.8.2 Design**

Contaminants, media, and site conditions are unique to each parcel of land; therefore sites at risk for contamination shall be reviewed on a case-by-case basis.

### **3.8.3 Soil Management**

All stockpiles shall comply with the City of Eugene Erosion Prevention Ordinance (Administrative Order 58-03-01-F). In addition, stockpiles of contaminated soils shall be covered with temporary impervious film or sheeting (such as plastic).

Stockpile perimeters shall have a containment barrier on all four sides of every stockpile to prevent stormwater run-on and material run-off. Barriers can consist of concrete curbing, silt fencing, or other berming material, depending on the activity, size, and resources available.

Areas under stockpiles of contaminated soils are not required to be paved. However, an impervious layer shall be placed beneath the stockpile to protect uncontaminated areas from potential leachate.

### **3.8.4 Construction Dewatering**

All construction dewatering discharges resulting from groundwater or precipitation (rainfall) shall be evaluated for contamination before disposal methods can be approved. A dewatering plan shall be submitted with the stormwater management plan for City review and approval. All construction dewatering shall comply with the City of Eugene Erosion Prevention Ordinance (Administrative Order 58-03-01-F).

### **3.8.5 Post-Construction Water Reclaim or Re-Use Systems**

If surface drainage systems are the proposed resource, discharges are expected to contain no contaminants so as not pose a threat to City infrastructure. Review will verify that there is no interaction between groundwater and the surface.

Non-potable uses for plumbing fixtures and industrial equipment, *i.e.* cooling towers or boilers, will require the following:

- a) A discharge meter shall be installed on the outlet of the re-use system for sewer billing purposes.
- b) Industrial equipment bleed-offs or drain valves shall have discharges routed to the wastewater line of the facility.
- c) Overflows from the re-use system shall be plumbed to sanitary and may require a wastewater discharge permit.

### **3.8.6 Laboratory Analysis Reports**

Laboratory analysis reports are required to identify the characteristics and levels of contamination in the soils and groundwater of a site.

An additional review process will be applied to these reports to determine regulatory authority and requirements. Testing and analysis are highly recommended prior to building permit applications. DEQ permitting and/or review may be required if contaminants are found, and levels of contamination appear to exceed the City's local discharge regulations. This may delay issuance of related building permits.

Lab analysis reports shall include the following information:

- a) Analysis reports shall identify the elevation of the seasonal water table and identify the depth of any perched water aquifers.
- b) Analysis reports shall identify the method of laboratory testing, the detection level and analytical method for detection, and the depth of any found contaminants in the soils.
- c) Minimum test parameters for base line contaminants shall include: metals (arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, silver, and zinc), PH 505-12.0, TPH (total petroleum hydrocarbons), and BTEX (benzene, toluene, ethyl-benzene and xylene).
- d) Test parameters may be required to include other contaminants as identified through historical data, research and environmental assessments.

### **3.8.7 Permanent Monitoring Points**

To ensure compliance with local discharge regulations, a suitable monitoring point may be required to monitor groundwater discharges to an off-site City sewer system. Monitoring requirements will be identified as part of the review process of the laboratory analysis reports and the building permit application. If monitoring is necessary, a permanent structure (such as a sampling manhole or flow through vault) shall be installed on the discharge line of the subsurface drainage system.

Structure type and location will need to be approved by the City, complying with Eugene Code. For technical assistance on suitable monitoring points, contact PW staff at 541-682-8616.

### **3.9 COVERED VEHICLE PARKING STRUCTURES, EC 9.6795 (2)(h)**

*Covered Vehicle Parking Structures* include enclosed buildings, not including single-level covers such as canopies, overhangs, and carports, used to cover parked vehicles.

#### **3.9.1 Drainage**

Stormwater runoff **from the top floor** of a multi-level parking structure shall be directed to a stormwater destination that meets all water quality requirements of this manual and any other applicable code requirements.

Drainage **from lower floor** of a multi-level parking structure is not expected to accumulate significant amounts of precipitation runoff and drainage facilities are not required for the lower floors. If the applicant elects to install drainage facilities, the drainage from the lower floors shall be directed to an approved City wastewater facility.

#### **3.9.2 Adjacent, Uncovered Portions of the Site**

The surrounding uncovered portions of the site shall be designed so stormwater does not enter the covered parking areas. This can be accomplished through grading, drains, or exterior walls.

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## Chapter 4.0

### OPERATING & MAINTAINING STORMWATER FACILITIES

This chapter presents operation and maintenance (O & M) requirements for the stormwater management facilities in this manual.

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## 4.1 INTRODUCTION

This chapter provides the operation and maintenance requirements for stormwater management facilities designed and constructed for flood control, stormwater quality, flow control, and source control compliance continue to function in which they were designed.

This chapter also provides pre-approved operations and maintenance (O & M) Plans for various stormwater management facilities outlined in this manual. Applicants proposing to construct a manufactured treatment device are required to submit an O & M Plan prepared by the manufacturer; the plan must include O & M activities consistent with the requirements of this Chapter.

The O & M strategies in this chapter apply to all types of stormwater management facilities and related facility components identified in **Chapter 2.0**. Facilities that are proposed as flood control only facilities, and that are not required to meet stormwater quality or flow control standards, are not required to submit an O & M packet. However, stormwater flood control facilities are required to be operated and maintained in working condition for the life of the facility.

Sample forms and inspection logs are provided in **Appendix C**.

## 4.2 PRIVATE FACILITIES

To demonstrate that private facilities required pursuant to EC 9.6791-9.6795 will be properly operated and maintained, applicants must submit an Operation and Maintenance packet (O & M packet) with their development permit application. A complete O & M packet must be approved by the City prior to issuance of the construction permit. An O & M Packet for facilities shall include all of the following:

- A copy of the recorded Notice of Operation & Maintenance Form (O & M Notice, see **Appendix C**);
- The stormwater management site plan detailing the stormwater management for the development must show the location of the stormwater facilities on the site, the sources of runoff entering the facility, and the ultimate stormwater destination. The site plans shall be legible with a font size no smaller than 11 point and a page size no smaller than 8.5 x 11 inches;
- An Operations & Maintenance Plan (O & M Plan, see **Appendix C**);
- The approved landscape plan; and
- A copy of the Stormwater Management Facility Inspection and Maintenance Log.

Copies of the approved O & M packets will be kept by the owner and on file at the Public Works Maintenance Division, 1820 Roosevelt Avenue, Eugene, OR 97402.

### 4.2.1 Notice of Operations & Maintenance Form

The O & M Notice gives notice to existing and future property owners that stormwater runoff from impervious surfaces constructed on the subject premises requires stormwater management facilities that are located, designed, and constructed in compliance with this Manual; and that the owners of the property are required to operate and maintain the facilities in accordance with the approved O & M Plan. Signatures on the O & M Notice must be notarized and the document must be recorded at Lane County Deeds and Records. After the City has reviewed and approved the O & M Notice, it may be submitted to the County for recording either in person or mailed, along with payment of the applicable fees, to the [Lane County Clerk's Office](#), Lane County Deeds and Records, 125 E. 8th Avenue, Eugene, OR 97401. The stormwater management site plan shall be incorporated by reference, yet, not recorded with the Notice of O & M Form.

The property description on the O & M Notice must be a full legal description of the property; a tax lot number cannot be used to describe the property.

The O& M Notice shall be printed on legal-sized (8.5" x 14") paper to facilitate the recording process.

### 4.2.2 Operations & Maintenance Plans

Operations and maintenance plans for all stormwater facilities shall be prepared and included as part of the O & M packet. Each plan shall identify the stormwater facility, operation, maintenance, training, inspection, spill management, and pest control responsibilities. O & M Plans are not recorded with the O & M Notice; this allows the future

owners of the stormwater management facilities to submit O & M activity revisions to the City without the need to re-record the O & M Plan with the County.

***Pre-approved Operations & Maintenance Plans.*** An O & M Plan for the chosen type of stormwater facility must be included in the **O & M Packet** and approved as part of the stormwater management facility construction permit. Pre-approved O & M Plans identifying specific maintenance activities for the facilities approved in **Chapter 2** of this Manual are provided in this chapter. Applicants may either select and use the pre-approved O & M Plans provided in this chapter or prepare an O & M Plan that incorporates the specific activities that corresponds with their chosen type of stormwater facilities.

***Operations & Maintenance Plans for Proprietary Facilities.*** Proprietary Operations & Maintenance plans for approved proprietary facilities must describe the inspection, cleaning, operation and maintenance criteria for the facility.

***O & M Plan Modifications.*** With approval, an O & M Plan may be modified by the facility-owner any time after issuance of the construction permit. The ability to modify the O & M Plan provides facility owners an opportunity to adjust maintenance needs according to site-specific history and conditions. Letters requesting modifications to an existing O & M Plan must be submitted, along with the proposed amended O & M Plan, to the Public Works Department, 1820 Roosevelt Avenue, Eugene, OR 97402. Modification requests must demonstrate that the stormwater facilities will continue to be operated and maintained in compliance with Eugene Code 9.6797.

### **4.2.3 Stormwater Management Facility Inspection and Maintenance Log**

Specific operation and maintenance activities for each of the different types of stormwater facilities include inspection as well as maintenance responsibilities. Facility owners must document and keep on file stormwater management facility inspection and maintenance logs. The logs must note all inspection dates, the facility components that were inspected, and any maintenance or repairs made to the facility. The O & M Plans can serve as a checklist for what should be included in the inspection log (*e.g.* the facility elements that need to be inspected, frequency of inspection, conditions that indicate maintenance is needed, *etc.*). See **Appendix C** for a sample **Inspection and Maintenance Log**. Proprietary and manufactured stormwater facility owners are required to submit a stormwater facility maintenance log provided by the proprietor.

### **4.2.4 Enforcement**

Pursuant to EC 6.615, stormwater management facilities constructed to comply with the requirements of EC 9.6792-9.6795 and this Manual must be properly operated and maintained for the life of the facility. The Notice of Operations and Maintenance Form will identify the parties responsible for the on-going private operation and maintenance.

Pursuant to Eugene Code 6.615, the City has the right and responsibility to inspect private facilities to assure they are being operated and maintained in accordance with the approved design, the O & M Plan, the Eugene Code and this Manual.

### **4.3 PUBLIC FACILITIES**

Public stormwater facilities will be operated and maintained by the City. In accordance with EC 7.145, prior to issuance of the PEPI permit, the owner/developer is required to submit a Performance and Warranty Bond for a period of at least 1 year for all public stormwater facilities. This bond amount shall be calculated as directed in the Public Improvement Design Standards (PIDS) Manual. Operation and maintenance activities will start when the facilities constructed as part of a privately engineered public improvement (PEPI) construction project is placed on warranty.

### **4.4 SOURCE CONTROLS**

Source Control measures typically include structural and non-structural controls used to manage potential pollutants at the site and prevent them from entering the City's stormwater system. Structural controls include Spill Control Manholes and lynch-type catch basins. Non-structural controls include street sweeping and other good housekeeping practices.

All required Source Control measures shall be operated, maintained, and inspected annually in compliance with Chapters 6, 7, and 9 as outlined in this manual. Annual inspection logs shall be kept by the owner and made available to City staff upon request.

### **4.5 PRE-APPROVED OPERATIONS AND MAINTENANCE PLANS**

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#### 4.5.1 Contained Planter O & M Plan

**Contained Planters** are free-standing plant containers placed over impervious surfaces such as patios, sidewalks, and rooftops that intercept and filter rainfall that would otherwise contribute to stormwater runoff from the underlying impervious surface.

Contained Planters may be prefabricated pots of various dimensions or may be constructed in place and have an infinite variety of shapes and sizes. Contained Planters intercept precipitation only, not stormwater runoff from other surfaces. Drainage is allowed through the bottom of the Contained Planter onto the impervious surface.

All facility components and vegetation shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation and 2 times per year thereafter.

**Training and/or Written Guidance** information for operating and maintaining Contained Planters shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to the Contained Planter shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the Contained Planter shall be removed.
- **Debris and Litter** shall be removed routinely.
- **Filter Media** consisting of sand and/or topsoil shall be tested to ensure stormwater percolates through the Contained Planter. Water should drain through the planter within 3-4 hours after a storm event. Remove and replace sand and/or topsoil to correct percolation deficiencies.
- **Mulch** shall be replenished at least annually.
- **Planter Walls** shall be examined for deficiencies, such as rot, cracks, and failure, and repaired as needed. Holes that are not consistent with the design and allow water to flow directly through the Contained Planter to the ground shall be plugged.
- **Vegetation** shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Dead vegetation shall be removed to maintain less than 10% of area coverage or when planter function is impaired. Vegetation shall be replaced within a specific timeframe, e.g., 3 months, or immediately, if required to maintain cover density and control erosion where soils are exposed. Vegetation, large shrubs or trees that limit access or interfere with the Contained Planter operation shall be pruned or removed. Fallen leaves and debris from deciduous plant foliage shall be removed. Nuisance and prohibited vegetation shall be removed when discovered.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

## 4.5.2 Eco-Roof O & M Plan

**Eco-Roofs** are lightweight vegetated roof systems used in place of conventional roofs. Eco-Roofs provide stormwater management by capturing, filtering, and, depending on the season, evapo-transpirates 10 to 100 percent of the precipitation while providing aesthetic and energy conservation benefits.

All facility components, including the growth medium, vegetation, drains, membranes, and roof structure shall be inspected for proper operations, integrity of the waterproofing, and structural stability throughout the life of the Eco-Roof. All elements shall be inspected once a month from April through September.

**Aesthetics** of the Eco-Roof shall be maintained as an asset to the property owner and community. Evidence of damage or vandalism shall be repaired and accumulation of trash or debris shall be removed upon discovery.

**Training and/or Written Guidance** information for operating and maintaining Eco-Roofs shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to the Eco-Roof shall be safe and efficient. Walkways shall be clear of obstructions.
- **Debris and Litter** shall be removed to prevent clogging of drainage and damaging plant growth. Fallen leaves and debris from deciduous plant foliage shall be removed.
- **Growing Medium** shall be inspected for evidence of erosion from wind or water. If erosion channels are evident, they shall be stabilized with additional soil substrate/growth medium and covered with additional plants.
- **Structure Components** shall be operated and maintained in accordance with manufacturer's requirements. Drain inlets shall be kept unrestricted. Inlet pipe shall be cleared when sedimentation, vegetation, debris or other materials clog the drain inlet. Sources of sediment and debris shall be identified and corrected. Determine if drain inlet pipe is in good condition and correct as needed.
- **Vegetation** shall be maintained to provide 90% plant cover. During the Establishment Period, plants shall be replaced once per month as needed. During the long-term period, dead plants shall generally be removed and replaced once per year in the Fall months. Weeding shall be manual without the use of herbicides or pesticides. Weeds shall be removed regularly and not allowed to accumulate. Only non-chemical fertilizers may be used, if necessary. During drought conditions, mulch or shade cloth may be applied to prevent excess solar damage and water loss. Mowing of grasses shall occur as needed. Clippings shall be removed.

**Irrigation** can be accomplished either through hand watering or automatic sprinkler systems. If automatic sprinklers are used, manufacturer's instructions for operations and maintenance shall be followed.

- During the Establishment Period (2 years), water sufficiently to assure plant establishment and not to exceed  $\frac{1}{4}$  inch of water once every 3 days shall be applied.
- During the long-term period (2+ years), water sufficiently to maintain plant cover and not to exceed  $\frac{1}{4}$  inch of water once every 14 days shall be applied.

**Spill Prevention Measures** from mechanical systems located on Eco-Roofs shall be exercised when handling substances that can contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

### 4.5.3 Permeable Pavement O & M Plan

**Permeable Pavements** are pervious and porous load bearing structures with an underlying stone reservoir that temporarily stores and filters surface runoff before infiltrating into the subsoil or being collected in underlying drain pipes and being discharged off-site. Permeable Pavements include, but are not limited to, pervious concrete, asphalt, plastic rings planted with grass, stone and block pavers. The system generally consists of a permeable wearing course surface placed upon layered permeable base materials.

All facility components shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event.

**Training and/or Written Guidance** information for operating and maintaining Permeable Pavement shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to the Permeable Pavements shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the Porous Pavement shall be removed.
- **Pavement Surfaces** shall be kept clean and free of leaves, debris, and sediment. The surface shall not be overlaid with an impermeable paving surface. Regular sweeping shall be implemented for porous asphalt or concrete systems.
- **Overflows or Emergency Spillways** are used in the event that the facility's infiltration capacity is exceeded. Overflow devices shall be inspected for obstructions or debris, which shall be removed upon discovery. Overflow or emergency spillways shall be capable of transporting high flows of stormwater to an approved stormwater receiving system. Sources of erosion damage shall be identified and controlled when native soil is exposed near the overflow structure.
- **Vacuuuming** of the facility shall be provided to remove fine particulate matter that will degrade the performance of the facility over time.
- **Vegetation** such as trees and shrubs, should not be located in or around the Permeable Pavement because roots from trees can penetrate the pavement, and leaves from deciduous trees and shrubs can increase the risk of clogging the surface. Vegetation and large shrubs/trees that limit access or interfere with Porous Pavement operation shall be pruned.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Release of pollutants on Permeable Pavements shall be corrected as soon as identified.

A spill prevention plan shall be implemented at all non-residential sites and in areas where there is likelihood of spills from hazardous materials. However, virtually all sites, including residential and commercial, present potential danger from spills. All homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, solvents, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important to exercise caution when handling substances that can contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

#### 4.5.4 Tree Credit O & M Plan

**Trees** intercept precipitation and hold water on the leaves and branches and allow it to evaporate, retain runoff and dissipate the energy of runoff. They also provide shade, providing two direct benefits. First, hard surfaces are protected from direct solar exposure, which reduces heat gain. The less heat gain there is in pavement, the less heat is absorbed by stormwater as it flows over the surface. Second, by shading pavement, the trees help reduce or minimize air temperature increases caused by the hot pavement. Cooler air may help prevent stream temperature increases associated with air temperatures.

These functions are most measurable for storms of less than 0.5 inches over 24 hours. While deciduous trees are not as effective during winter months, evergreen trees are effective year round for these smaller storms and portions of larger storms. Generally, large trees with small leaves are the most efficient rainfall interceptors. Trees also facilitate stormwater infiltration and groundwater recharge.

Trees used to meet stormwater management requirements shall be kept on a site and maintained properly to ensure continued stormwater benefits. Trees shall be inspected 2 times a year and within 48 hours of a major wind or storm event.

**Inspection Logs** shall be kept by the Tree owner demonstrating the following items have been inspected and are being maintained properly:

- **Dead Trees** shall be removed and replaced with a comparable. The replacement Tree shall be a minimum of 6' tall at planting.
- **Dead Vegetation** shall be pruned from the Tree on a regular basis.
- **Poisonous and Nuisance Vegetation** around the Tree shall be removed when discovered.
- **Protection** of the Tree trunk and roots shall ensure Tree survival. Care should be taken when digging near Tree roots.

**Irrigation** shall be implemented during the establishment period to ensure Tree survival. Hand watering is preferred, but a drip-irrigation system may be used.

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#### 4.5.5 Filter Strip O & M Plan

**Filter Strips** are gently sloped vegetated or grassed areas that stormwater runoff is directed to flow over and filter through. Stormwater enters the filter as sheet flow from an impervious surface or is converted to sheet flow using a level spreader. Pollutants are removed through filtration and sedimentation.

All facility components and vegetation shall be inspected for proper sheet flow and stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event.

**Training and/or Written Guidance** information for operating and maintaining vegetated filters shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to the filter strip shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Channelization** and causes for altered water flow shall be identified and corrected upon discovery. Stormwater should exit the vegetative filter as sheet flow, unless a collection drainpipe is used.
- **Debris and Litter** shall be removed to prevent channelization, clogging, and interference with plant growth. Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- **Erosion Damage** shall be identified and controlled when native soil is exposed or erosion channels are forming.
- **Inlets** shall be cleared when conveyance capacity is plugged to ensure unrestricted stormwater flow to the vegetated filter.
- **Level Spreaders** shall allow water to exit as sheet flow.
- **Nuisance and Prohibited Vegetation** from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- **Outlets** shall be cleared when 50% of the conveyance capacity is plugged.
- **Sedimentation** build-up near or exceeding 2" in depth shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- **Vegetation** shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Dead vegetation shall be removed to maintain less

than 10% of area coverage or when vegetative filter function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

#### 4.5.6 Pond O & M Plan

**Ponds** are constructed ponds with a permanent pool of water. Pollutants are removed from stormwater through gravitational settling and biologic processes. Extended Wet Ponds are constructed ponds with a permanent pool of water and open storage space above for short-term detention of large storm events. Pollutants are removed from stormwater through gravitational settling and biologic processes. Dry Detention Ponds are constructed ponds with temporary storage for the detention of large storm events. The stormwater is stored and released slowly over a matter of hours.

All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. Gauges located at the opposite ends of the wet pond shall be maintained to monitor sedimentation. Gauges shall be checked 2 times per year. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event.

**Training and/or Written Guidance** information for operating and maintaining Ponds shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to Ponds shall be safe and efficient. Vehicular routes shall be maintained to design standards to accommodate size and weight of vehicles. Obstacles preventing maintenance personnel and/or equipment access shall be removed.
- **Debris and Litter** shall be removed to prevent channelization, clogging, and interference with plant growth. Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- **Erosion Damage** shall be identified and controlled when native soil is exposed or erosion channels are forming.
- **Inlets** shall be cleared when conveyance capacity is plugged to ensure unrestricted stormwater flow to the wet pond.
- **Nuisance or Prohibited Vegetation** from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- **Outlets and Overflow Structures** shall be cleared when 50% of the conveyance capacity is plugged.
- **Piping** shall be examined and re-installed if more than 1-inch of settlement. Remove sediment deposits to maintain flow capacity.
- **Rocks or Other Armoring** shall be replaced when only one layer of rock exists above native soil.

- **Sedimentation** build-up near or exceeding 50% of the facility capacity shall be removed every 2-5 years, or sooner if performance is being affected. Wet Ponds shall be dredged when 1 foot of sediment accumulates in the pond.
- **Slopes** shall be stabilized using appropriate measures when native soil is exposed.
- **Vegetation** shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion and minimizing solar exposure of open water areas. Vegetation producing foul odors shall be eliminated. Dead vegetation shall be removed to maintain less than 10% of area coverage or when wet pond function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed. Vegetation, large shrubs or trees that limit access or interfere with wet pond operation shall be pruned or removed. Grass (where applicable) shall be mowed to 4"-9" high and grass clippings shall be removed.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified. Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

- If a complaint is received or an inspection reveals that the pond is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee will be required to eliminate the infestation. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City.
- Acceptable methods include but are not limited to the following:
  - Installation of predacious bird or bat nesting boxes.
  - Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
- If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides *Bacillus thurengensis* var. *israeliensis* or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.

#### 4.5.7 Rain Garden O & M Plan

**Rain Gardens** are vegetated surface reservoirs used to collect and treat stormwater runoff from impervious surfaces by allowing the pollutants to settle and filter out as the water percolates through vegetation and soil mediums before infiltrating into the ground below or being piped to its downstream destination.

Rain Gardens can be used to help fulfill a site's required landscaping area requirement and should be integrated into the overall site design. Numerous design variations of shape and planting scheme can be used to fit the character of a site.

The reservoir basin shall infiltrate stormwater within 24 hours. All facility components and vegetation shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event.

**Training and/or Written Guidance** information for operating and maintaining vegetated infiltration basins shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to Rain Gardens shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Debris and Litter** shall be removed to prevent channelization, clogging, and interference with plant growth. Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- **Erosion Damage** shall be identified and controlled when native soil is exposed or erosion channels are forming.
- **Grassed Rain Gardens** shall be mowed to 4"-9" high and grass clippings shall be removed no less than 2 times per year.
- **Infiltrating Rain Gardens** shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates.
- **Inlets** shall be cleared when conveyance capacity is plugged to ensure unrestricted stormwater flow to the rain garden.
- **Mulch** shall be replenished as needed to ensure healthy plant growth.
- **Nuisance and Prohibited Vegetation** from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- **Outlets** shall be cleared when 50% of the conveyance capacity is plugged.
- **Overflows** shall be cleared when 25% of the conveyance capacity is plugged.

- **Rocks or Other Armoring** shall be replaced when only one layer of rock exists above native soil.
- **Sedimentation** build-up near or exceeding 2” in depth shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- **Slopes** shall be stabilized using appropriate measures when native soil is exposed.
- **Vegetation** shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

#### 4.5.8 Sand Filter O & M Plan

**Sand Filters** consist of a layer of sand in a structural box used to trap pollutants. The water filters through the sand and then infiltrates into the ground or has an underdrain system that conveys the filtered stormwater to a discharge point.

All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event.

**Training and/or Written Guidance** information for operating and maintaining Sand Filters shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to the Sand Filter shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the facility shall be removed.
- **Debris and Litter** shall be removed to ensure stormwater infiltration and to prevent clogging. Debris in quantities more than 1 cu ft or sufficient to inhibit operation shall be removed upon discovery. Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- **Erosion Damage** shall be identified and controlled when native soil is exposed or erosion channels are forming.
- **Infiltrating Sand Filters** shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates.
- **Inlet** shall allow water to uniformly enter the Sand Filter as calm flow, in a manner that prevents erosion. Clear sediment and debris when 40% of the conveyance capacity is plugged.
- **Nuisance or Prohibited Vegetation** from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed.
- **Piping** shall be cleared of sediment and debris to maintain conveyance capacity.
- **Sedimentation** shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- **Structural Deficiencies** in the Sand Filter box including rot, cracks, and failure shall be repaired upon discovery. Holes that are not consistent with the design structure and allow water to flow directly through the Sand Filter to the ground shall be filled. Rocks or other armament shall be replaced when sand is exposed and eroding from wind or rain.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

#### 4.5.9 Stormwater Planter O & M Plan

**Stormwater Planters** are infiltration and filtration stormwater facilities that can provide flood control, flow control and stormwater quality benefits. Stormwater Planters are walled vegetated surface reservoirs used to collect and treat stormwater runoff from impervious surfaces by allowing pollutants to settle and filter out as the water percolates through the vegetation and soil mediums before infiltrating into the ground below or being piped to its downstream destination.

Stormwater Planters can be used to help fulfill a site's required landscaping area requirement and should be integrated into the overall site design. Numerous design variations of shape and planting scheme can be used to fit the character.

All facility components and vegetation shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event.

**Training and/or Written Guidance** information for operating and maintaining Stormwater Planters shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to Stormwater Planters shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Debris and Litter** shall be removed to prevent channelization, clogging, and interference with plant growth. Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- **Erosion Damage** shall be identified and controlled when native soil is exposed or erosion channels are forming.
- **Filter Media** consisting of sand and/or topsoil shall be tested to ensure stormwater percolates through the planter. Remove and replace sand and/or topsoil to correct percolation deficiencies.
- **Infiltrating Stormwater Planters** shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates. Water should drain through the planter within 3-4 hours after a storm event.
- **Inlets** shall be cleared when conveyance capacity is plugged to ensure unrestricted stormwater flow to the rain garden.
- **Mulch** shall be replenished as needed to ensure healthy plant growth.
- **Nuisance and Prohibited Vegetation** from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive

vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.

- **Outlets** shall be cleared when 50% of the conveyance capacity is plugged.
- **Piping** shall be cleared of sediment and debris to maintain conveyance capacity.
- **Planter Walls** shall be examined for deficiencies, such as rot, cracks, and failure, and repaired as needed. Holes that are not consistent with the design and allow water to flow directly through the planter to the ground shall be plugged.
- **Sedimentation** build-up near or exceeding 2" in depth shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- **Vegetation** shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

#### 4.5.10 Swale O & M Plan

Swales are filtration stormwater conveyance facilities that provide flow control and stormwater quality benefits. Swales are long and narrow vegetated and grassed depressions used to collect and convey stormwater runoff which allows pollutants to settle and filter out as the water flows through the facility.

All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event.

**Training and/or Written Guidance** information for operating and maintaining Swales shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to Swales shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Channelization** and causes for altered water flow shall be identified and corrected upon discovery. Stormwater should exit the vegetative filter as sheet flow, unless a collection drainpipe is used.
- **Debris and Litter** shall be removed to prevent channelization, clogging, and interference with plant growth. Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- **Erosion Damage** shall be identified and controlled when native soil is exposed or erosion channels are forming.
- **Grassed Swales** shall be mowed to 4"-9" high and grass clippings shall be removed no less than 2 times per year.
- **Infiltrating Swales** shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates. The Swale should drain within 48 hours of a storm event.
- **Inlets** shall maintain a calm flow of water entering the Swale and shall be cleared when conveyance capacity is plugged to ensure unrestricted stormwater flow to the rain garden.
- **Mulch** shall be replenished as needed to ensure healthy plant growth.
- **Nuisance and Prohibited Vegetation** from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- **Outlets** shall be cleared when 50% of the conveyance capacity is plugged.

- **Sedimentation** build-up near or exceeding 2” in depth shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- **Slopes** shall be stabilized to prevent erosion and failure using appropriate measures when native soil is exposed.
- **Vegetation** shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

#### 4.5.11 Spill Control Manhole O & M Plan

**Spill Control Manholes** are source control devices specific to controlling oil releases. Spill Control Manholes rely on passive mechanisms that take advantage of oil being lighter than water. Oil floats to the surface and is periodically removed. Spill Control Manholes are simple underground manhole designs with a “T” outlet designed to trap small spills. Spill Control Manholes must be used in conjunction with other water quality systems to meet stormwater quality requirements.

The Spill Control Manhole shall be inspected and cleaned quarterly.

**Training and/or Written Guidance** information for operating and maintaining Spill Control Manholes shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to Swales shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Absorbent Pillows and Pads** (where applicable) absorbing oil from the separation chamber shall be replaced at least twice a year, in the spring and fall, or as necessary to retain oil-absorbing function.
- **Cleaning** shall be done without use of detergents or surfactants. A pressure washer may be used if necessary.
- **Debris/Sediment** that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.
- **Holes** in the ground located in and around the manhole shall be filled.
- **Inlet Pipe** shall be inspected for clogging or leaks where it enters the manhole during every inspection and cleanout.
- **Manhole Chamber** shall be inspected for cracks or damage during each inspection.
- **Outlet Pipe** shall be inspected for clogging or leaks where it exits the manhole. Cleaning shall be done in a manner to minimize the amount of trapped oil entering the outlet pipe. If there is a valve on the outlet pipe it shall be closed otherwise the outlet will be plugged prior to cleanout.
- **Water and Oil** shall be removed, tested, and disposed of in accordance with regulations. Grit and sediment that has settled to the bottom of the chamber shall be removed during each cleaning.
- **Vegetation** such as trees should not be located in or around the Spill Control Manhole because roots can penetrate the unit body, and leaves from deciduous trees and shrubs can increase the risk of clogging. Large shrubs or trees that are

likely to interfere with manhole operation shall be identified at each inspection and removed.

**Source Control Measures** typically include structural and non-structural controls. Non-structural controls can include street sweeping and other good housekeeping practices. Source Control measures shall be maintained and documented.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Spill Prevention procedures require high-risk site users to reduce the risk of spills. However, virtually all sites, including residential and commercial, present dangers from spills. Homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, nail polish remover, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important to exercise caution when handling substances that can contaminate stormwater.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

#### 4.5.12 Structural Detention Facility O & M Plan

**Structural Detention Facilities** are flow control devices. Structural detention facilities include tanks, vaults, and oversized pipes designed to fill with stormwater during large storm events and slowly release the runoff over a number of hours. There are numerous components to each system; inlet pipes conveying stormwater into the detention facility, detention chambers storing stormwater during storm events, and outlet drains restricting the flow out of the detention chamber.

Underground Structural Detention Facilities shall be inspected quarterly and within 48 hours after each major storm event.

**Training and/or Written Guidance** information for operating and maintaining Detention Facilities shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to the detention facility shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Debris/Sediment** that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.
- **Detention Chamber** shall be cleaned out yearly or after an inch of sediment has accumulated and inspected for cracks or damage. Grit and sediment that has settled to the bottom of the chamber shall be removed during each cleaning. Cleaning shall be done without use of detergents or surfactants. A pressure washer may be used if necessary.
- **Inlets** shall be cleared when conveyance capacity is plugged to ensure unrestricted stormwater flow.
- **Outlets** shall be cleared when 50% of the conveyance capacity is plugged.
- **Vegetation** such as large shrubs or trees that are likely to interfere with detention facility operation shall be identified at each inspection then removed.

**Spill Prevention Measures** shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

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#### 4.5.13 Drywell O & M Plan

**Drywells** are structural subsurface facilities with perforated sides or bottom, used to inject stormwater runoff into the ground. **Drywells** systems consist of concrete or plastic manhole section with many small holes in the sides to allow stormwater to infiltrate into the surrounding soil.

The Drywell system shall be inspected and cleaned quarterly and within 48 hours after each major storm event. Ponding around the catch basins or sedimentation manhole or drywell lids may indicate that the drywell is failing due to siltation, or the clogging of the sediment pores surrounding the Drywell.

**Training and/or Written Guidance** information for operating and maintaining drywell systems shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to the Drywell shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Debris/Sediment** that is found to clog the pipe shall be removed and disposed of in accordance with applicable federal and state requirements.
- **Failing Drywells** shall be repaired and/or replaced.
- **Shut-Off Valve or Flow-Blocking Mechanism** may have been required with the construction of the drywell to temporarily prevent stormwater from flowing into it, in the event of an accidental toxic material spill. This may also involve mats kept on-site that can be used to cover inlet drains in parking lots. The shut-off valve shall remain in good working order, or if mats or other flow-blocking mechanisms are used, they shall be kept in stock on-site.
- **Vegetation** such as trees should not be located in or around the drywell because roots from trees can penetrate the unit body, and leaves from deciduous trees and shrubs can increase the risk of clogging the intake pipe. Large shrubs or trees that are likely to interfere with operation will be identified at each inspection and removed.

**Spill Prevention Measures** shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

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#### 4.5.14 Soakage Trench O & M Plan

**Soakage Trenches** are infiltrating flood control devices. Soakage Trenches are linear excavations backfilled with sand and gravel injecting stormwater runoff into the ground recharging groundwater. There are various components within the system – inlet piping, aggregate storage basin and perforated piping. The trench surface may be covered with grating, stone, sand, or a grassed cover with a surface inlet and may also be installed under hard surfaces such as driveways.

All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first two years from the date of installation, then two times per year afterwards, or within 48 hours after each major storm.

**Training and/or Written Guidance** information for operating and maintaining Soakage Trenches shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

**Inspection Logs** shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to the Soakage Trench shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Algae Growth** located on top of the soakage trench should be removed and disposed of properly.
- **Debris/Sediment** that is found to clog the pipe shall be removed and disposed of in accordance with applicable federal and state requirements.
- **Failing Soakage Trenches** shall be repaired and/or replaced if water is noticed on top of trench within 48 hours of a major storm.
- **Piping** shall be cleared of sediment and debris to maintain conveyance. If piping is clear of sediment and debris and yet conveyance is poorly maintained, fabric around the pipe shall need replacing.
- **Shut-Off Valve or Flow-Blocking Mechanism** may have been required with the construction of the drywell to temporarily prevent stormwater from flowing into it, in the event of an accidental toxic material spill. This may also involve mats kept on-site that can be used to cover inlet drains in parking lots. The shut-off valve shall remain in good working order, or if mats or other flow-blocking mechanisms are used, they shall be kept in stock on-site.
- **Sediment** in the aggregate obstructing storage and infiltration shall be excavated and replaced.
- **Vegetation** such as trees should not be located in or around the soakage trench because roots from trees can penetrate the unit body, and leaves from deciduous

trees and shrubs can increase the risk of clogging the intake pipe. Large shrubs or trees that are likely to interfere with operation will be identified at each inspection and removed.

**Spill Prevention Measures** shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

**Non-Chemical Pest Control** measures shall be taken to prevent development of insects, mosquitoes, and rodents.

# APPENDICES

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2014



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**Appendix A: Eugene Code (EC) - Stormwater Development Standards (EC Section 9.6790-9.6797), Stormwater Facility Operation and Maintenance (EC 6.615), Public Improvement Construction - Wastewater Sewer Systems and Stormwater Management Facilities (EC 7.143)** includes Eugene Code sections that regulate stormwater management policies and standards, and that authorizes the City's *Stormwater Management Manual* and stormwater management enforcement authority and requirements.

**Appendix B: Typical Facility Details** presents typical cross sectional detail for stormwater management facilities.

**Appendix C: Forms** includes SIM Form, DAR Form, Notice of O & M and O & M forms for recording purposes.

**Appendix D: Facility Planting Design** presents plant species recommendations for vegetated stormwater facilities.

**Appendix E: Approved Proprietary Stormwater Treatment Technologies** lists all proprietary stormwater treatment technologies approved for use to meet Eugene's stormwater quality requirements.

**Appendix F: Flow Control Structure and Pipe Outfall Sizing** present guidance and requirements for the design of flow control structures and pipe outfalls.

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**Appendix I: Infiltration Limited Areas Map and NRCS Soils Group Map** presents areas which may be infiltration limited due to generalized site conditions such as soil type and groundwater depth.

**Appendix J: Headwater Streams Map** presents headwater streams identified for flow controls.

**Appendix K: Flood Control Design Storm Tables** outlines the rainfall intensity, duration and frequency curves, storm recurrence intervals, and storm events for planning and designing stormwater flood control facilities.

**Appendix L: Water Quality Design Storm Development** outlines the rationale behind the development of Eugene's stormwater quality storm events.

**Appendix M: Santa Barbara Urban Hydrograph Method** describes the Santa Barbara Urban Hydrograph method and includes the City's 24-hour rainfall depths, formulas for computing time of concentration, and runoff curve numbers.

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**APPENDIX A**

**EUGENE CITY CODE SECTIONS  
EC 9.6790-9.6796  
EC 6.615  
EC 7.143**

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## Eugene City Code Sections 9.6790 - 9.6796

**9.6790**     **Stormwater Management Manual.** In order to implement Section 9.6791 through 9.6797 of this code, the City Manager shall adopt in accordance with EC 2.019, City Manager – Administrative and Rulemaking Authority and Procedures, a Stormwater Management Manual. The Stormwater Management Manual may contain forms, maps and facility agreements and shall include requirements that are consistent with the following goals:

- (1) Reduce runoff pollution from development by reducing impervious surfaces and capturing and treating approximately 80% of the average annual rainfall.
- (2) Control and minimize flows from development in the Headwater Areas using a variety of techniques to release water to downstream conveyance systems at a slower rate and lower volume, thereby reducing the potential for further aggravation of instream erosion problems.
- (3) Emphasize stormwater management facilities that incorporate vegetation as a key element, and include design and construction requirements that ensure landscape plant survival and overall stormwater facility functional success.
- (4) Operate and maintain stormwater management facilities in accordance with facility-specific O & M Plans.
- (5) Reduce pollutants of concern that are generated by identified site uses and site characteristics that are not addressed solely through the stormwater quality measures by implementing additional specific source control methods including reducing or eliminating pathways that may introduce pollutants into stormwater, capturing acute releases, directing wastewater discharges and areas with the potential for relatively consistent wastewater discharges to the wastewater system, containing spills on site, and avoiding preventable discharges to wastewater facilities, surface waters or ground waters.
- (6) Except as otherwise allowed by this land use code, allow disturbances or development within drainage ways only when all of the following conditions exist:
  - (a) The disturbance or development will not impede or reduce flows within the drainage way;
  - (b) The disturbance or development will not increase erosion downstream; and
  - (c) The constructed pipe system is sized to convey all of the runoff from the upstream watershed when the upstream watershed is completely developed.

*(Section 9.6790 added by Ordinance No. 20369, enacted June 14, 2006, effective July 14, 2006; amended by Ordinance No. 20417, enacted August 11, 2008, effective July 7, 2009; and Ordinance No. 20521, enacted January 13, 2014, effective March 1, 2014.)*

### **9.6791**     **Stormwater Flood Control.**

- (1) **Purpose.** The purpose of EC 9.6791 is to protect life and property from flood and drainage hazards by maintaining the capacity of the city's stormwater conveyance system through the establishment of flood control regulations for stormwater runoff.

**(2) Applicability and Exemptions.**

- (a) Except as provided in EC 9.6791(2)(b), flood control standards apply to all development permit applications and land use applications.
- (b) The standards in EC 9.6791(3) do not apply to development permit applications where the proposed development will be served by a flood control facility that is a manmade drainage system designed to accommodate stormwater run-off generated by the stormwater basin area.

**(3) Standards.**

- (a) Stormwater flood control facilities shall be designed and constructed according to adopted plans and policies, and in accordance with standards in EC Chapters 6 and 7, and the stormwater flood control provisions and the facility design requirements set forth in the Stormwater Management Manual.
- (b) Based on the Rational Method flow calculation, stormwater runoff from the development site for the flood control design storm shall be:
  - 1. Discharged into existing stormwater flood control facilities that, considering all developments that have received tentative or final plan approval as of the date the applicant submits a complete application, have the capacity to handle the stormwater runoff; or
  - 2. Retained or detained onsite; or
  - 3. Discharged into a new stormwater flood control facility constructed by the applicant.

**(4) Underground Injection Control Systems.** Stormwater runoff discharged in underground systems is also regulated through the federal Underground Injection Control (UIC) program under Part C of the Safe Drinking Water Act (42 U.S.C. § 300, Chapter 6A, Subchapter XII) and Oregon Administrative Rule Chapter 340, Section 044.

*(Section 9.6791 added by Ordinance No. 20369, enacted June 14, 2006, effective July 14, 2006; amended by Ordinance No. 20417, enacted August 11, 2008, effective July 7, 2009; and Ordinance No. 20521, enacted January 13, 2014, effective March 1, 2014.)*

**9.6792 Stormwater Quality.**

- (1) Purpose.** The purpose of EC 9.6792 is to reduce runoff pollution and mitigate the volume, duration, time of concentration and rate of stormwater runoff from development by implementing stormwater management techniques that promote the use of natural and built systems for infiltration, evapotranspiration and reuse of rainwater and that use or mimic natural hydrologic processes while capturing and treating approximately 80% of the average annual rainfall.
- (2) Applicability and Exemptions.**
  - (a) The standard in EC 9.6792(3)(a) applies to all land use applications submitted after March 1, 2014, that do not propose construction of a public street, private street or a shared driveway.
  - (b) The standards in EC 9.6792(3)(b), (e)-(g) apply to all land use applications submitted after March 1, 2014, that propose construction of a public street.
  - (c) The standards in EC 9.6792(3)(c), (e)-(g) apply to all land use applications submitted after March 1, 2014, that propose construction of a private street or shared driveway.

- (d) Except as exempt under EC 9.6792(2)(e), the standards in EC 9.6792(3)(d)-(g) apply to applications for all development permits submitted after March 1, 2014.
- (e) The standards in EC 9.6792(3)(d)-(g) do not apply to development permit applications:
  1. For the construction of less than 1,000 square feet of new or replaced impervious surface within a 12 month period;
  2. For interior alterations of an existing structure;
  3. For the construction of more than 1,000 square feet of impervious surface that replaces existing impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system (including pipes, drainageway catch basins and drywells) on the development site;
  4. For the construction of new or replaced impervious surface where all of the stormwater runoff from the impervious surface will discharge into an on-site, privately maintained underground injection control system that is registered and approved by the Oregon Department of Environmental Quality;
  5. For the construction of a one or two family dwelling on a lot or parcel that was created by a land division application submitted and approved by the City prior to March 1, 2014, that is consistent with the approved land use application and the City's stormwater quality (pollution reduction) standards in place at the time of the land division application; or
  6. For the construction of a one or two family dwelling on a lot or parcel that was created by a land division application that included the construction of a public or private street or shared driveway submitted and approved by the City after March 1, 2014, if the lot or parcel adjoins the public or private street or shared driveway and the facility within the public or private street or shared driveway is an infiltration or filtration facility designed and sized to accommodate stormwater runoff from the adjoining lots or parcels at full buildout of the lots or parcels.

**(3) Standards.**

- (a) For land use applications not proposing the construction of a public or private street or shared driveway, the applicant shall submit a site development plan that delineates the following conditions existing on the development site:
  1. Infiltration rates less than 2 inches per hour;
  2. Bedrock less than 5 feet below the ground surface;
  3. Groundwater elevations less than 6 feet; or,
  4. Ground surface slopes greater than 10%.
- (b) For land use applications proposing the construction of a public street, stormwater quality facilities to treat the stormwater runoff from the proposed public street shall be selected from the Stormwater Management Manual and shall be based on the following priority order: infiltration, filtration, mechanical treatment.
  1. If selecting an infiltration or filtration facility to treat the stormwater runoff from the public street, the facility can be sized to also treat

- the stormwater runoff from the one and two family dwelling lots or parcels adjoining the public street based on full buildout of those lots or parcels.
2. If using a mechanical facility to treat the stormwater runoff from the public street or if the infiltration or filtration facility is not sized to also treat the stormwater runoff from the adjoining lots or parcels at full buildout, all lots or parcels created by the land division application shall comply with EC 9.6792(3)(d)-(g) at the time of development permit application.
- (c) For land use applications proposing construction of a private street or shared driveway, stormwater quality facilities to treat the runoff from the proposed private street or shared driveway shall be selected from the Stormwater Management Manual and shall be based on the following priority order: infiltration, filtration.
1. An infiltration or filtration treatment facility to treat the stormwater runoff from the shared driveway or private street can be sized to treat the stormwater runoff from the proposed one and two family dwelling lots or parcels that adjoin the shared driveway or private street based on full buildout of those lots or parcels.
  2. If the infiltration or filtration facility is not sized to treat the stormwater runoff from the adjoining lots or parcels at full build out, all lots or parcels created by the land division application must comply with EC 9.6792(3)(d)-(g) at the time of development permit application.
- (d) For development permit applications, stormwater quality facilities shall be selected from the Stormwater Management Manual and shall be based on the following priority order: infiltration, filtration, off-site stormwater quality management.
1. If selecting a filtration treatment facility, the applicant shall submit a report that demonstrates at least one of the following development site conditions exist:
    - a. Infiltration rates are less than 2 inches per hour;
    - b. Bedrock is less than 5 feet below the ground surface;
    - c. Groundwater elevations are less than 6 feet; or,
    - d. Ground surface slopes are greater than 10%.
  2. If selecting off-site stormwater quality management by contributing to the public off-site stormwater quality facilities, through payment of a higher stormwater system development charge adopted as part of the City's system development charge methodology, the applicant shall submit a report that demonstrates there is insufficient land area to construct an approved infiltration or filtration facility by setting forth the required size of the smallest infiltration or filtration facility needed for the development's impervious surface area and a site plan demonstrating that an approved infiltration or filtration facility cannot be located on the development site without reducing the size of the proposed development which is otherwise consistent with all other applicable lot and development standards.
- (e) The selected stormwater quality facilities shall treat all stormwater runoff from all new or replaced impervious surface areas, or an equivalent on-site area, that will result from the water quality design storm except that

the selected the stormwater quality facility does not need to treat the stormwater runoff from new or replaced impervious surface that is 500 sq. feet or less and does not gravity-feed into the selected treatment facility.

- (f) All stormwater quality facilities shall be sited, designed and constructed according to the water quality provisions and the facility design requirements set forth in the Stormwater Management Manual.
- (g) The standards in EC 9.6792(3) may be adjusted pursuant to EC 9.8030(24).

*(Section 9.6792 added by Ordinance No. 20369, enacted June 14, 2006, effective July 14, 2006; and Ordinance No. 20521, enacted January 13, 2014, effective March 1, 2014.)*

### **9.6793 Stormwater Flow Control (Headwaters).**

- (1) Purpose.** The purpose of EC 9.6793 is to protect waterways in the headwaters area from the erosive affects of increases in stormwater runoff peak flow rates and volumes resulting from development.
- (2) Applicability and Exemptions.**
  - (a) Except as exempt under EC 9.6793(2)(c), the standards in EC 9.6793(3) apply to all land use applications for development sites in the headwaters area that drain directly into a headwater stream or drain into a pipe that discharges into a headwater stream that are submitted after July 14, 2006 requesting approval of one or more of the following:
    - 1. A cluster subdivision - tentative plan (EC 9.8055);
    - 2. A conditional use (EC 9.8090 or 9.8100);
    - 3. A partition - tentative plan (EC 9.8215 or 9.8220);
    - 4. A planned unit development - tentative plan (EC 9.8320 or 9.8325);
    - 5. Site review (EC 9.8440 or 9.8445);
    - 6. A subdivision tentative plan (EC 9.8515 or 9.8520).
  - (b) Except as exempt under EC 9.6793(2)(c), the standards in EC 9.6793(3) apply to all applications for development permits for development sites in a headwaters area that drain directly into a headwater stream or drain into a pipe that discharges into a headwater stream that are submitted after July 14, 2006.
  - (c) The standards in EC 9.6793(3) do not apply to:
    - 1. A land use application that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development.
    - 2. A development permit application for any of the following:
      - a. Development of a lot or parcel included in a land use application that was determined by the city to comply with the standards in EC 9.6793(3). For such a development permit, the approved land use plan shall control.
      - b. Development of a lot or parcel that was not included in a land use application that was determined by the city to comply with the standards in EC 9.6793(3) and:
        - (1) Will result in less than 1,000 square feet of new or replaced impervious surface within a 12 month period; or
        - (2) Is to construct or alter a one or two family dwelling; or

- (3) Is for the replacement of more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system (including pipes, drainageway catch basins and drywells) on the development site.
3. Development sites within a drainage basin for which the city has constructed or approved a project to restore the receiving waterway, and the entire downstream system has been designed to accommodate full build-out conditions within the drainage basin.
- (3) Standards.**
- (a) Applications shall demonstrate, using methodology in the Stormwater Management Manual, that peak rates of flow delivered to an existing open waterway at a point above 500 feet in elevation will not increase during storms larger than the water quality design storm and smaller than the flood control design storm as a result of the development that is the subject of the application;
  - (b) For purposes of designing the system as required by the standards in this section, the amount of impervious surface per lot is assumed to be the maximum lot coverage allowed for the use in the zone in which it is located, unless the applicant demonstrates otherwise.
  - (c) All facilities to control the rate of stormwater runoff shall be sited, designed and constructed according to the flow control provisions and the facility design requirements set forth in the Stormwater Management Manual. Flow control facilities must be designed using one of the methodologies outlined in the Stormwater Management Manual.
  - (d) The standards in EC 9.6793(3) may be adjusted pursuant to EC 9.8030(24).

*(Section 9.6793 added by Ordinance No. 20369, enacted June 14, 2006, effective July 14, 2006.)*

**9.6794 Stormwater Oil Control.**

- (1) Purpose.** The purpose of EC 9.6794 is to protect the city's stormwater system from oil and grease from stormwater runoff of impervious surface areas on properties that produce high concentrations of these pollutants.
- (2) Applicability.** Oil control standards set forth in EC 9.6794(3) apply to:
  - (a) All new commercial and industrial development with parking lots that store wrecked or impounded vehicles; or
  - (b) Any development that would result in an expected daily traffic count greater than one hundred vehicles per 1,000 square feet of gross building area, based on the most recent version of The Institute of Transportation Engineers' Trip Generation Manual; or
  - (c) Any development that would result in 100 or more off-street parking spaces; or
  - (d) Any commercial or industrial development that receives an adjustment approving the installation of 125 percent or more of the minimum off-street parking spaces required by EC 9.6410(3), Minimum Number of

Required Off-Street Parking Spaces and that adjustment will result in, at least, a total of 10 parking spaces.

- (3) **Standards.** Unless adjusted pursuant to EC 9.8030(24), all oil control facilities shall be sited, designed and constructed according to the oil control provisions and the facility design requirements set forth in the Stormwater Management Manual.

*(Section 9.6794 added by Ordinance No. 20369, enacted June 14, 2006, effective July 14, 2006.)*

#### **9.6795 Stormwater Source Controls.**

- (1) **Purpose.** The purpose of EC 9.6795 is to prevent stormwater pollution by eliminating pathways that may introduce pollutants into stormwater.
- (2) **Applicability and Exemptions.** Except as exempted below and except when the source control would duplicate source controls required by a state or federal permit obtained by the applicant, source control standards set forth in EC 9.6795(3), apply to all land use applications, development permits and tenant improvements that result in any of the defined site uses or characteristics listed in EC 9.6795(2)(a)–(h).
- (a) Fuel dispensing facilities and surrounding traffic areas where vehicles, equipment, or tanks are refueled on the premises. A fuel dispensing facility is the area where fuel is transferred from bulk storage tanks to vehicles, equipment, and/or mobile containers. Exempt from this subsection are:
1. Propane tanks.
  2. Fuel dispensing areas generally used to service oversized equipment, for example cranes, that cannot maneuver under a roof or canopy.
  3. Existing fueling areas where scope of work is limited to a new canopy installation over an existing fuel pad that is not being upgraded, an underground tank replacement for compliance with state regulations, or the replacement of a fuel pump on an existing fuel pad that is not being upgraded.
- (b) Exterior storage of liquid materials, for example chemicals, food products, waste oils, solvents, process wastewaters, or petroleum products in aboveground containers, in quantities of 50 gallons or more, including permanent and temporary storage areas. Exempt from this subsection are underground storage tanks or installations requiring a Water Pollution Control Facility (WPCF) permit and containers with internal protections (such as double-walled containers).
- (c) All facilities that store solid waste. A solid waste storage area is a place where solid waste containers, including compactors, dumpsters, and garbage cans, are collectively stored. Solid waste storage areas include, areas used to collect and store refuse or recyclable materials collection areas. Exempt from this subsection are solid waste storage areas for one and two family dwelling and areas used for the temporary storage of wood pallets or cardboard.
- (d) Developments that stockpile or store high-risk or low-risk bulk materials in outdoor containers, as the terms “high risk” and “low risk” are in the Stormwater Management Manual. Exempt from this subsection are:
1. Materials which have no measurable solubility or mobility in water and no hazardous, toxic or flammable properties.

2. Materials which exist in a gaseous form at ambient temperature.
  3. Materials, except for pesticides and fertilizers, that are contained in a manner that prevents contact with stormwater.
- (e) Developments proposing the installation of new material transfer areas as defined in the Stormwater Management Manual, or structural alterations to existing material transfer areas, such as access ramp re-grading and leveler installations. Exempt from this subsection are areas used only for mid-sized to small-sized passenger vehicles and restricted by lease agreements or other regulatory requirements to storing, transporting or using materials that are classified as domestic use, for example, primary educational facilities (elementary, middle or high schools), buildings used for temporary storage and churches.
- (f) All development with a designated equipment or vehicle washing or steam cleaning area, including smaller activity areas such as wheel-washing stations. Exempt from this subsection are:
1. Washing activity areas generally used to service oversized equipment than cannot maneuver under a roof or canopy, for example cranes and sail boats.
  2. Evaporation unit installed as part of a wash recycling system are exempt from the wastewater connection requirement.
  3. One and two family dwelling sites.
- Development that is intended for the storage of 10 or more fleet vehicles shall include a designated vehicle washing area.
- (g) All development projects that disturb property suspected or known to contain contaminants in the soil or groundwater.
- (h) All development with new covered vehicle parking areas, or existing parking structures that are being developed. Exempt from this subsection are single-level canopies, overhangs and carports.
- (3) Standards.** Unless adjusted pursuant to EC 9.8030(24), all source controls shall be designed and constructed according to the source control provisions set forth in the Stormwater Management Manual.
- (4) Enforcement.** Failure to construct, operate and maintain source controls when a land use application, development permit or tenant improvement has resulted in a defined site use or characteristic listed in EC 9.6795(1)(a)-(h) is subject to enforcement in accordance with EC Chapter 6.

*(Section 9.6795 added by Ordinance No. 20369, enacted June 14, 2006, effective July 14, 2006.)*

#### **9.6796 Dedication of Stormwater Easements.**

- (1) Purpose.** The purpose of EC 9.6796 is to ensure that city maintained stormwater management facilities designed and constructed in accordance with EC 9.6791-9.6795 and the Stormwater Management Manual can be accessed by the city for routine and/or emergency maintenance to protect life and property from flood and drainage hazards, ensure that water quality is protected, and to ensure that waterways in the headwaters area are protected from the erosive effects of runoff.
- (2) Applicability.** Stormwater easement standards set forth in EC 9.6796(3) apply to all land use applications and development permits that result in the construction of a city maintained stormwater management facility.
- (3) Standards.** The applicant must dedicate public easements approved by the city over city maintained stormwater management facilities provided the city

makes findings to demonstrate consistency with constitutional requirements. The conveyance of ownership or dedication of easements may be required in any of the following circumstances:

- (a) Except for areas on the city's acknowledged Goal 5 inventory, where the subject property in the proposed development is or will be periodically subject to accumulations of surface water or is traversed by any open drainage way, headwater, stream, creek, wetland, spring, or pond, including those not maintained by the city which drain onto or from city-owned property or into city maintained facilities.
- (b) For areas on the city's acknowledged Goal 5 inventory, where the subject property in the proposed development is or will be periodically subject to accumulations of surface water or is traversed by any water course or channel.
- (c) Where necessary to extend public drainage facilities and services to adjoining undeveloped property.
- (d) To provide necessary drainage from the public right-of-way.
- (e) Where the facility will provide treatment for runoff from the public right-of-way and the City will be maintaining the facility.

*(Section 9.6796 added by Ordinance No. 20369, enacted June 14, 2006, effective July 14, 2006; administratively corrected January 1, 2008; and Ordinance No. 20521, enacted January 13, 2014, effective March 1, 2014.)*

**9.6797 Stormwater Operation and Maintenance.**

- (1) All stormwater facilities shall be operated and maintained in accordance with EC Chapters 6 and 7, and the Stormwater Management Manual.
- (2) Unless the applicant proposes private maintenance of the facility, a stormwater facility that will provide treatment for runoff from the public right-of-way shall be:
  - (a) Designed and constructed through the Privately Engineered Public Improvement (PEPI) process; and
  - (b) Located in public rights of way or public easements dedicated in accordance with EC 9.6796; and
  - (c) Selected from the list of stormwater facilities identified in the Stormwater Management Manual as a type of facility that the City will operate and maintain.

*(Section 9.6797 added by Ordinance No. 20369, enacted June 14, 2006, effective July 14, 2006; and Ordinance No. 20521, enacted January 13, 2014, effective March 1, 2014.)*

## Eugene City Code Section 6.615

### 6.615

#### **Stormwater Facility Operation and Maintenance.**

- (1) **Purpose.** The purpose of section 6.615 is to ensure that stormwater management facilities designed and constructed in accordance with sections 9.6790 through 9.6797 of this code and the Stormwater Management Manual adopted by administrative order of the city manager are operated and maintained in a manner that protects life and property from flood and drainage hazards, protects water quality, and protects the waterways in the headwaters area from the erosive effects of runoff.
- (2) **Applicability.** Section 6.615 applies to all stormwater facilities designed and constructed in accordance with sections 9.6791 through EC 9.6797 of this code and the Stormwater Management Manual.
- (3) **Maintenance responsibility.**
  - (a) Unless the city accepts the responsibility to operate and maintain a stormwater facility, all stormwater management facilities shall be privately operated and maintained.
  - (b) All stormwater facilities shall be operated and maintained in accordance with the applicant's Operations and Maintenance Plan submitted to the city with the application proposing the private operation and maintenance of the stormwater facility.
- (4) **Reports.** Periodic reports verifying that the stormwater facility is and has been operated and maintained as required in (3)(b) above, shall be prepared and submitted to the city within the time and manner required by administrative rules adopted by the city manager pursuant to section 2.019 of this code.
- (5) **Enforcement.**
  - (a) **Inspections.** The city may make periodic inspections to ensure compliance with this code, the Stormwater Management Manual, and the Operations and Maintenance Plan. Authorized representatives of the city may enter private property at reasonable times to ensure such compliance and to conduct on-site inspections or routine maintenance of stormwater facilities. If the premises are occupied, the city representative shall first present proper credentials and request entry. If the premises are unoccupied, reasonable efforts shall first be made to locate the owner or person in charge of the premises and request entry. No person shall deny a request for, or interfere or prevent any inspection authorized by this section. Should entry be refused, the city shall have recourse to every remedy provided by law to secure entry, including the issuance of a search warrant.
  - (b) **Violations.** Failure to operate and maintain a stormwater facility in accordance with section 6.615, the Stormwater Management Manual or the Operations and Maintenance Plan may result in:
    1. The issuance of a stop work order or compliance order by the city;
    2. The issuance of a citation into municipal court for violation of this code;
    3. The imposition of an administrative civil penalty pursuant to the provisions of section 2.018 of this code as authorized by section 6.995 of this code;

4. An order to investigate all of the impacts caused by the violation; and/or
  5. Abatement of the unlawful actions as a nuisance as provided in sections 6.005 through 6.115 of this code, including, but not limited to, complete restoration of all impacts to open waterways resulting from the unlawful actions.
- (c) For purposes of subsections (5)(b)2 and (5)(b)3 of section 6.615, each date that the unlawful condition exists shall constitute a separate violation.
  - (d) For purposes of enforcing an administrative civil penalty imposed under this section and, if applicable, entry of a lien pursuant to section 2.018(11), if the violation for which the penalty was imposed involves a stormwater facility located on a portion of a planned unit development, condominium or other development that is commonly owned or owned by a homeowners' association, each parcel or unit in the development shall be liable for the administrative civil penalty, and the city may enter a lien for the full amount of the unpaid administrative civil penalty against each parcel or unit in the development.
  - (e) Failure to file a periodic report required by subsection (4) of this section and administrative rules adopted pursuant to that section may result in imposition of an administrative civil penalty pursuant to the provisions of section 2.018 of this code.
  - (f) Appeal. Any person to whom a stop work order or compliance order is issued may appeal the stop work order or compliance order within the time and in the manner prescribed in section 2.021 of this code. Notwithstanding any other provision of this code, a stop work order or compliance order shall be effective upon issuance, and shall continue in effect during the pendency of any appeal.
- (6) Rules and fees.** The City manager may adopt rules and fees for implementation of section 6.615, using the procedures in sections 2.019 and 2.020 respectively of this code.

*(Section 6.615 added by Ordinance No. 20373, enacted November 22, 2006, effective December 22, 2006.)*

## Eugene City Code Section 7.143

### 7.143 **Public Improvement Construction – Wastewater Sewer Systems and Stormwater Management Facilities.**

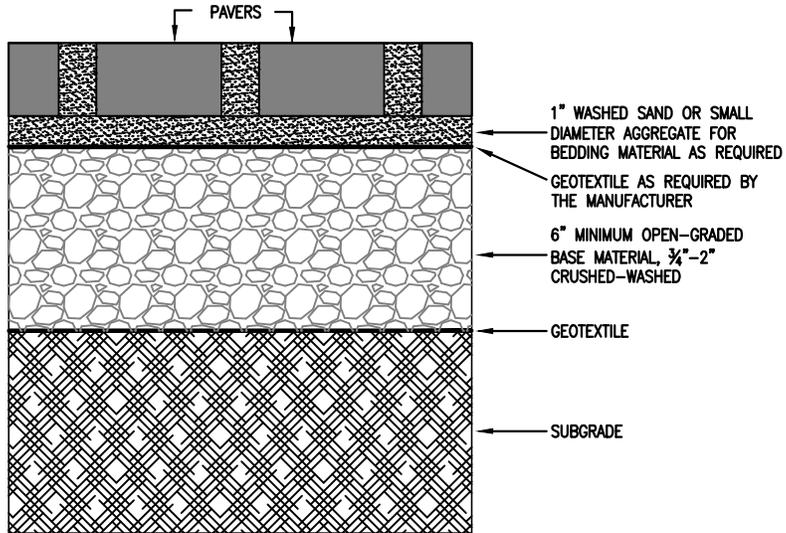
- (1) Unless physical constraints prevent construction or unless adjoining properties are outside the service basin, all public improvements to unimproved public ways not already containing a wastewater sewer system must include a wastewater sewer system constructed in accordance with section 7.085 of this code.
- (2) All public improvements to public ways must include stormwater management facilities that are constructed in accordance with the Design Standards for Stormwater Facilities in Public Improvement Projects. Capacity of the stormwater management facilities shall be sized in accordance with the flood control design storm. The pollution reduction facilities must treat all stormwater runoff from all new or replaced impervious surface exceeding 1000 square feet, or an equivalent on-site area, that will result from the water quality design storm.

*(Section 7.143 added by Ordinance No. 20390, enacted August 13, 2007, effective September 14, 2007.)*

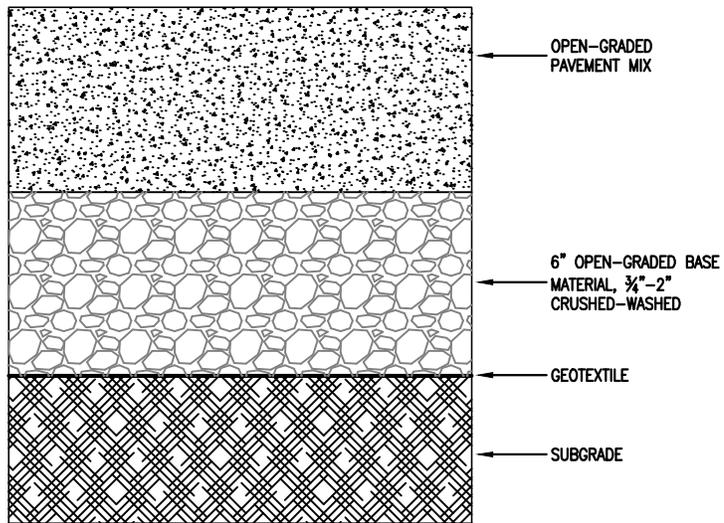
**APPENDIX B**

**TYPICAL FACILITY DETAILS**

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PERMEABLE CONCRETE BLOCK OR "PAVER" SYSTEMS



PERVIOUS (OPEN GRADED) CONCRETE AND ASPHALT

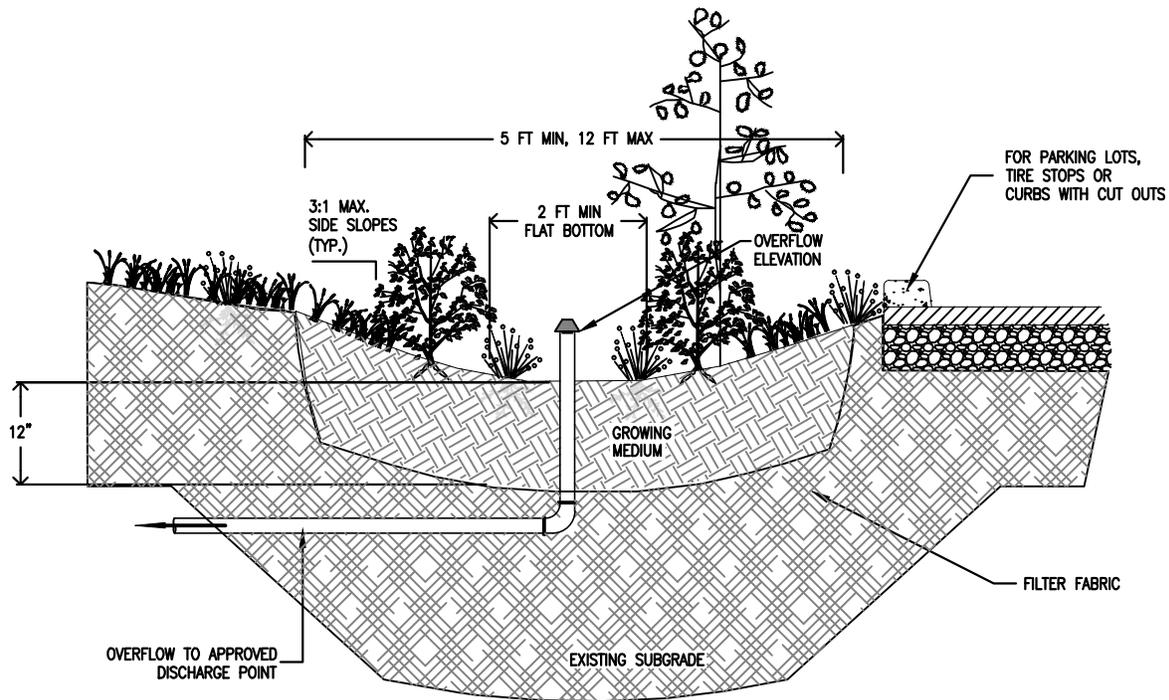


CITY OF  
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DEPARTMENT OF PUBLIC WORKS  
ENGINEERING DIVISION

PERMEABLE PAVEMENTS

TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.

2. Dimensions:

- a. Width of swale: 5' - 12'
- Depth of swale: 12"
- b. Longitudinal slope of swale: 0.5% min and 6% max.
- c. Flat bottom width: 2' minimum.
- d. Side slopes of swale: 3:1 maximum.

3. Setbacks (from centerline of facility):

- a. Infiltration swales must be 10' from foundations and 5' from property lines.
- b. Filtration swales must have a waterproof liner when within 10' from foundation of 5' from property lines.

4. Overflow:

- a. Overflows are required to an approved point discharge point unless sized to fully infiltrate the flood control design storm.
- b. Inlet elevation must allow for 2" of freeboard, minimum.

5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.

6. Drain rock:

- a. Size: 3/4" - 2-1/2" washed
- b. Depth: 12" minimum

7. A geotextile is required to isolate the drain rock from the subgrade and growing medium

8. Growing medium:

- a. 12" minimum
- b. Import topsoil or amended native soil

9. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Vegetative swales must have following plantings per 100sf of facility area:

- a. 100 Ground Covers, OR
- b. 80 Ground Covers, 2 Small Shrubs, 4 Large Shrubs, and 1 Tree (deciduous or evergreen)

10. Waterproof liner: Shall be 30 mil PVC or equivalent for flow-through facilities.

11. Install washed pea gravel or river rock to transition from inlets and splash pad to growing medium.

12. Check dams: Shall be placed at 12" intervals along the length of the swale.

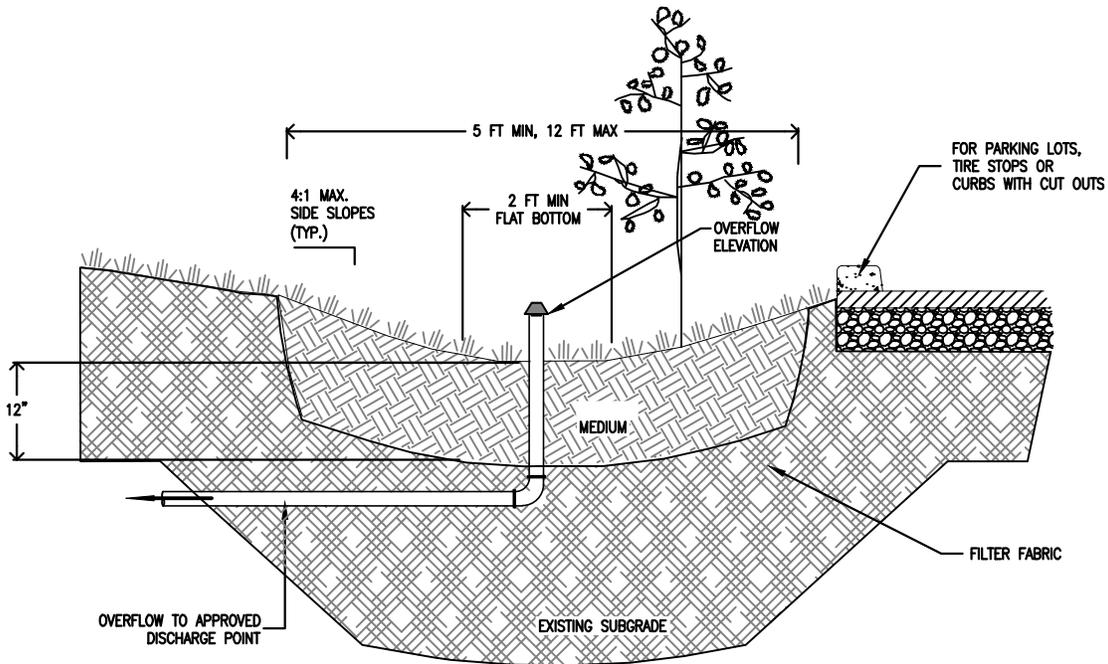


CITY OF  
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ENGINEERING DIVISION

VEGETATED SWALE

TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
  - a. Width of swale: 5' - 12'.
  - Depth of swale: 12"
  - b. Longitudinal slope of swale: 0.5% min and 6% max.
  - c. Bottom width: 2' minimum.
  - d. Side slopes: 3:1 maximum for vegetative and 4:1 for grassy.
3. Setbacks (from centerline of facility):
  - a. Infiltration swales must be 10' from foundations and 5' from property lines.
  - b. Filtration swales must have a waterproof liner when within 10' from foundation of 5' from property lines.
4. Overflow:
  - a. Overflows are required to an approved point discharge point unless sized to fully infiltrate the flood control design storm.
  - b. Inlet elevation must allow for 2" of freeboard, minimum.

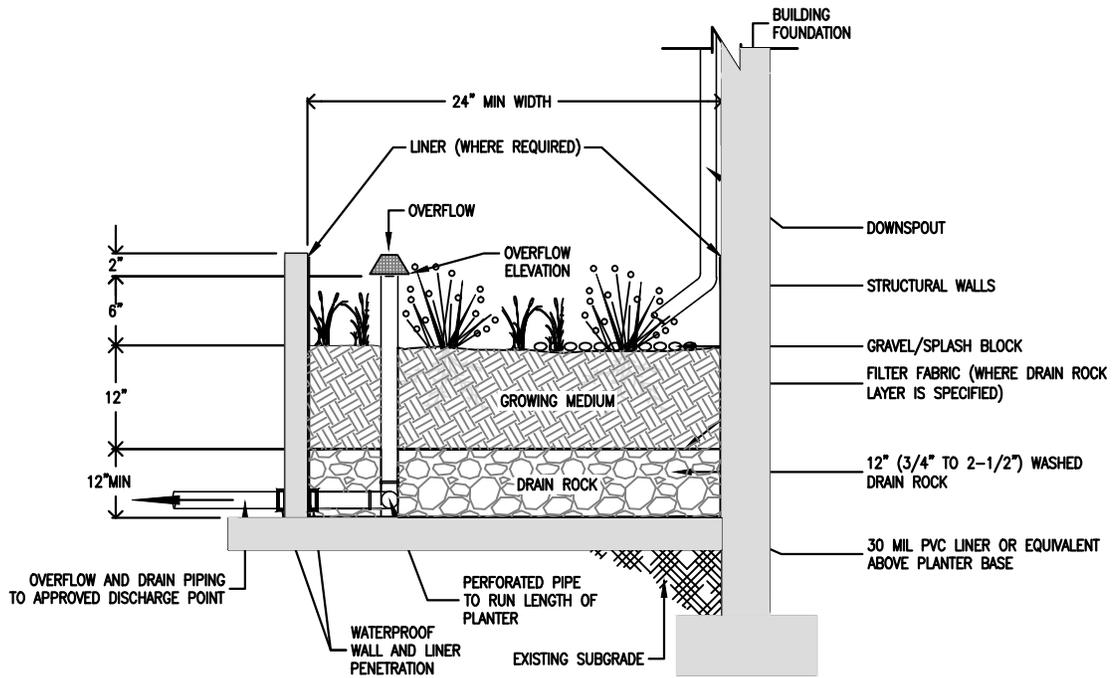
5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.
6. Growing medium:
  - a. 12" minimum
  - b. Import topsoil or amended native soil
9. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Grassy swales must have 100 coverage. Vegetative swales must have following plantings per 100sf of facility area:
  - a. 100 Ground Covers, OR
  - b. 80 Ground Covers, 2 Small Shrubs, 4 Large Shrubs, and 1 Tree (deciduous or evergreen)
10. Waterproof liner: Shall be 30 mil PVC or equivalent where required.
11. Install washed pea gravel or river rock to transition from inlets and splash pad to growing medium.
12. Check dams: Shall be placed at 12" intervals along the length of the swale.



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GRASSY SWALE  
TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



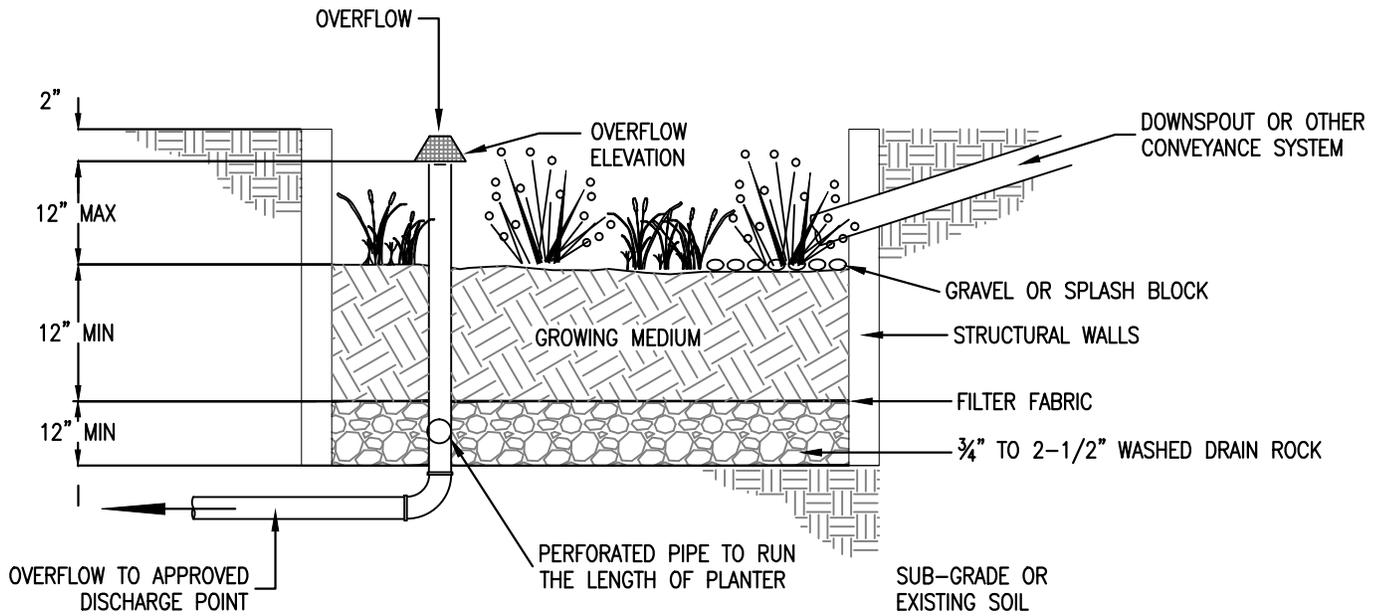
1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
  - a. Width of planter: 24" minimum.
  - b. Depth of planter: 6" minimum from top of growing medium to overflow elevation.
  - c. Slope of planter: 0.5% or less.
3. Setbacks:
  - a. Infiltration planters must be 10' from foundations and 5' from property lines.
  - b. Filtration planters do not require a setback with an approved waterproof liner.
4. Overflow:
  - a. Overflows are required to an approved discharge point when using the Simplified Method
  - b. Overflows are not required when sized to fully infiltrate the flood control event using the Presumptive Method.
  - c. Minimum 2" freeboard from overflow elevation to the top of the planter walls.
5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.
6. Drain rock:
  - a. Size: 3/4" to 2-1/2" diameter open graded
  - b. Depth: 12" Minimum
  - c. Length and Width: Full length and width of facility
7. Drain rock layer shall be separated from the growing medium by a geotextile
8. Growing medium:
  - a. 12" minimum
  - b. Import topsoil or amended native topsoil
9. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Number of plantings per 100sf of facility area:
  - a. 100 Ground Covers, OR
  - b. 80 Ground Covers and 4 Small Shrubs, OR
  - c. 60 Ground Covers and 12 Small Shrubs
10. Planter walls:
  - a. Material shall be stone, brick, concrete, wood, or other durable material (no chemically treated wood).
  - b. Walls shall be included on building plans here incorporated into foundations or other permitted structures..
11. Waterproof liner (where required): Shall be 30 mil PVC or equivalent.
12. Install washed pea gravel or river rock to transition from inlet or splash pad to growing medium.



CITY OF  
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DEPARTMENT OF PUBLIC WORKS  
ENGINEERING DIVISION

FOUNDATION  
FILTRATION PLANTER  
TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
  - a. Width of planter: 24" minimum.
  - b. Depth of planter: 6" minimum from top of growing medium to overflow elevation.
  - c. Slope of planter: 0.5% or less.
3. Setbacks:
  - a. Infiltration planters must be 10' from foundations and 5' from property lines.
  - b. Filtration planters do not require a setback with an approved waterproof liner.
4. Overflow:
  - a. Overflows are required to an approved discharge point when using the Simplified Method
  - b. Overflows are not required when sized to fully infiltrate the flood control event using the Presumptive Method.
  - c. Minimum 2" freeboard from overflow elevation to the top of the planter walls.
5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.
6. Drain rock:
  - a. Size: 3/4" to 2-1/2" diameter open graded
  - b. Depth: 12" Minimum
  - c. Length and Width: Full length and width of facility
7. Drain rock layer shall be separated from the growing medium by a geotextile filter fabric
8. Growing medium:
  - a. 12" minimum
  - b. Import topsoil or amended native topsoil
9. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Minimum container size is 1 gallon. # of plantings per 100sf of facility area:
  - a. 100 Ground Covers, OR
  - b. 80 Ground Covers and 4 Small Shrubs, OR
  - c. 60 Ground Covers and 12 Small Shrubs
10. Planter walls:
  - a. Material shall be stone, brick, concrete, wood, or other durable material (no chemically treated wood).
  - b. Walls shall be included on building plans here incorporated into foundations or other permitted structures..
11. Waterproof liner (where required): Shall be 30 mil PVC or equivalent.
12. Install washed pea gravel or river rock to transition from inlet or splash pad to growing medium.

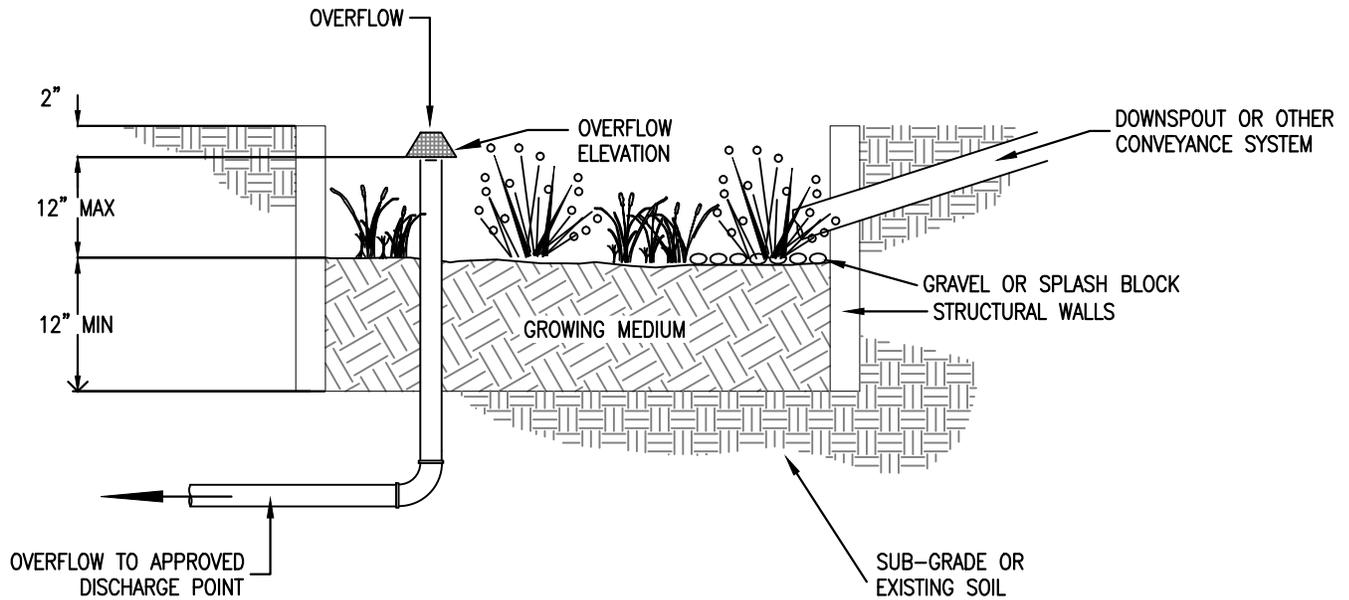


**CITY OF  
EUGENE, OREGON**  
 DEPARTMENT OF PUBLIC WORKS  
 ENGINEERING DIVISION

**FILTRATION PLANTER**

TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.

2. Dimensions:

- a. Width of planter: 24" minimum.
- b. Depth of planter: 6" minimum from top of growing medium to overflow elevation.
- c. Slope of planter: 0.5% or less.

3. Setbacks:

- a. Infiltration planters must be 10' from foundations and 5' from property lines.
- b. Filtration planters do not require a setback with an approved waterproof liner.

4. Overflow:

- a. Overflows are required to an approved discharge point when using the Simplified Method
- b. Overflows are not required when sized to fully infiltrate the flood control event using the Presumptive Method.
- c. Minimum 2" freeboard from overflow elevation to the top of the planter walls.

5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.

6. Growing medium:

- a. 12" minimum
- b. Import topsoil or amended native topsoil

9. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Minimum container size is 1 gallon.

# of plantings per 100sf of facility area:

- a. 100 Ground Covers, OR
- b. 80 Ground Covers and 4 Small Shrubs, OR
- c. 60 Ground Covers and 12 Small Shrubs

10. Planter walls:

- a. Material shall be stone, brick, concrete, wood, or other durable material (no chemically treated wood).
- b. Walls shall be included on building plans here incorporated into foundations or other permitted structures..

11. Install washed pea gravel or river rock to transition from inlet or splash pad to growing medium.

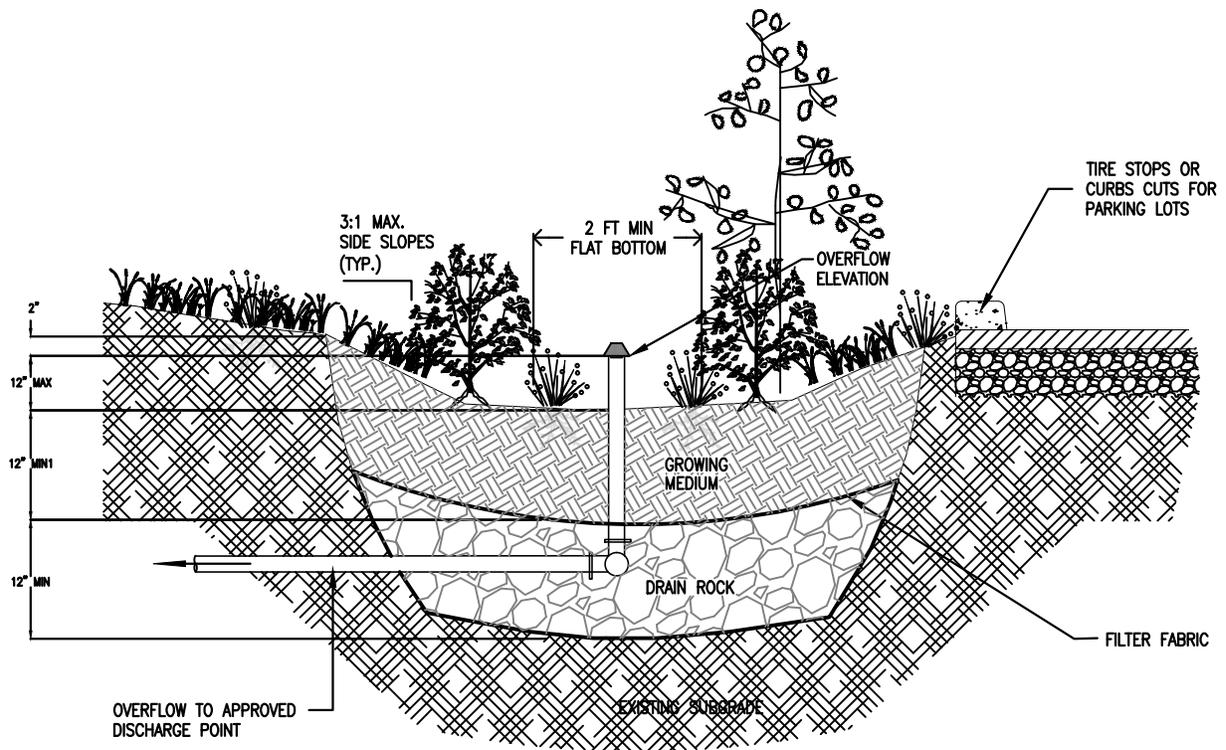


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ENGINEERING DIVISION

INFILTRATION PLANTER

TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
  - a. Depth of rain garden: 6" minimum and 12" maximum
  - b. Flat bottom width: 2' min.
  - c. Side slopes of Rain Garden: 3:1 maximum.
3. Setbacks:
  - a. Infiltration rain gardens must be 10' from foundations and 5' from property lines.
  - Filtration Rain Garden do not require a setback with an approved waterproof liner.
4. Overflow:
  - a. Overflows are required unless sized to fully infiltrate the flood control design storm.
  - b. Inlet elevation must allow for 2" of freeboard, minimum.
5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.

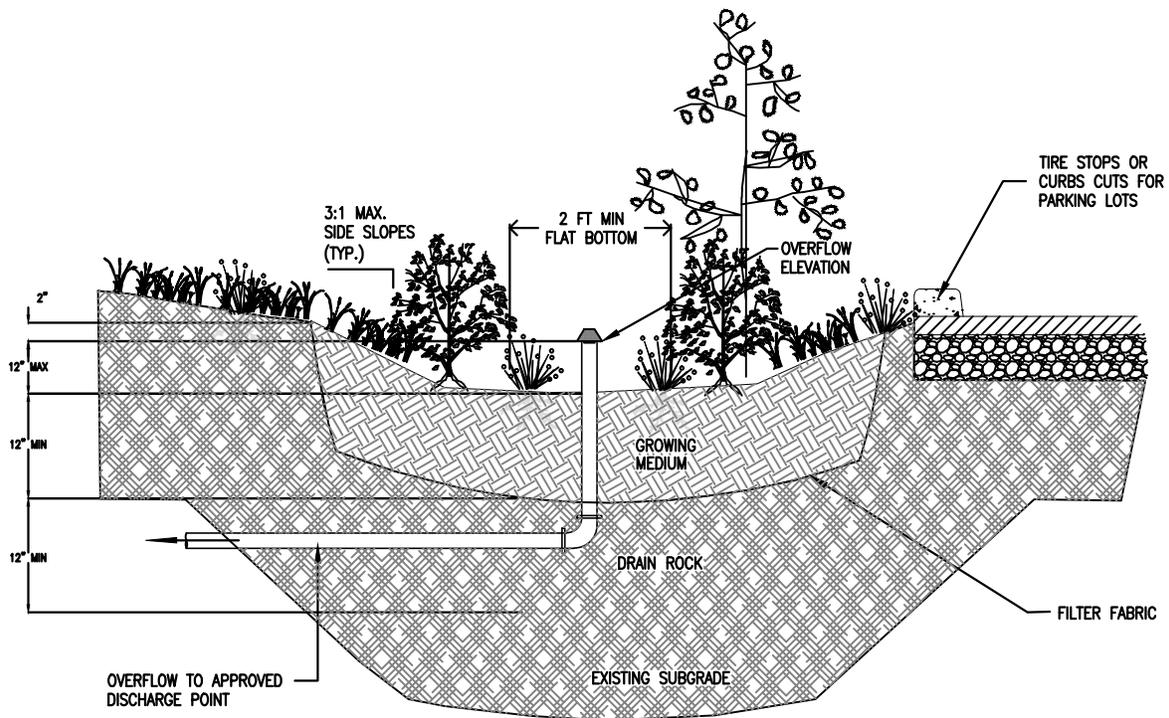
6. Drain rock:
  - a. Size: 3/4"-2-1/2" washed
  - b. Depth: 12" Minimum
7. Drain rock later shall be separated from the growing medium and the surround soils by a geotextile filter fabric.
8. Growing medium:
  - a. 12" minimum
  - b. Imported topsoil or amended native topsoil.
- Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Number of plantings per 100sf of facility area:
  - a. 100 Ground Covers, OR
  - b. 80 Ground Covers, 2 Large Shrubs 4 Small Shrubs and 1 tree (deciduous or evergreen)
10. Install washed pea gravel or river rock to transition from inlets and splash pad to growing medium.



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DEPARTMENT OF PUBLIC WORKS  
ENGINEERING DIVISION

FILTRATION RAIN GARDEN  
  
TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
  - a. Depth of rain garden: 6" minimum and 12" maximum
  - b. Flat bottom width: 2' min.
  - c. Side slopes of Rain Garden: 3:1 maximum.
3. Setbacks:
  - a. Infiltration rain gardens must be 10' from foundations and 5' from property lines. Filtration Rain Garden do not require a setback with an approved waterproof liner.
4. Overflow:
  - a. Overflows are required unless sized to fully infiltrate the flood control design storm.
  - b. Inlet elevation must allow for 2" of freeboard, minimum.

5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.

6. Growing medium:
- a. 12" minimum
  - b. Imported topsoil or amended native topsoil.

Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Number of plantings per 100sf of facility area:

- a. 100 Ground Covers, OR
- b. 80 Ground Covers, 2 Large Shrubs 4 Small Shrubs and 1 tree (deciduous or evergreen)

10. Install washed pea gravel or river rock to transition from inlets and splash pad to growing medium.

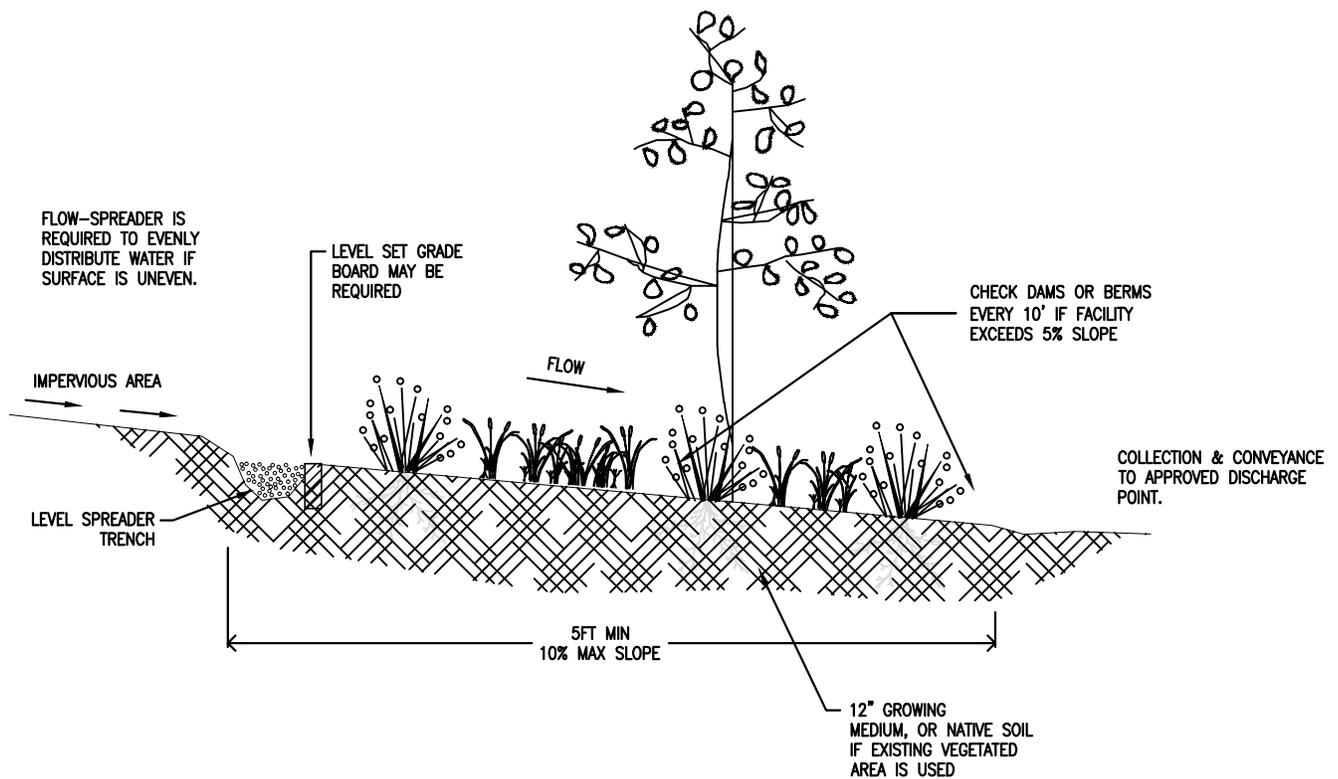


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DEPARTMENT OF PUBLIC WORKS  
ENGINEERING DIVISION

INFILTRATION RAIN GARDEN

TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



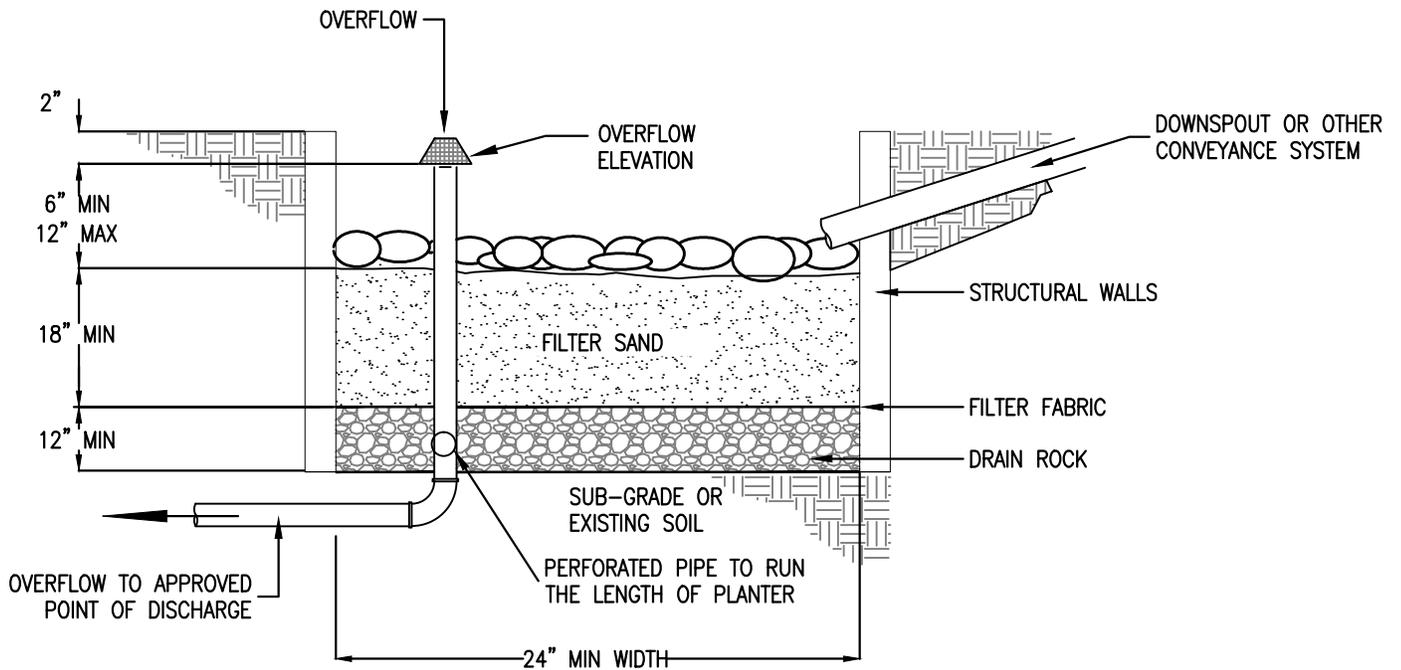
1. Provide protection from all vehicle traffic, equipment staging, as well as foot traffic for proposed infiltration areas prior to and during construction.
2. Dimensions:
  - a. Flow line length: 5' minimum.
  - b. Slopes: 0.5 - 10%
3. Setbacks (from beginning of facility):
  - a. 5' from property line
  - b. 10ft from buildings
  - c. 50ft from wetlands, rivers, streams, and creeks where required.
4. Overflow: Collection from filter strip shall be specified on plans to approved discharge point.
5. Growing medium: Unless existing vegetated areas are used for the filter strip, growing medium shall be used within the top 12".
6. Vegetation: The entire filter strip must have 100% coverage by native grasses, native wildflower blends, native ground covers, or any combination thereof. Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Number of plantings per 100sf of facility area:
  - a. 100 Ground Covers, OR
  - b. 80 Ground Covers, 4 Small Shrubs, OR
  - c. 60 Ground Covers, 12 Small Shrubs
7. Level Spreaders: A grade board, perforated pipe, berm or trench may be required to disperse the runoff evenly across the filter strip to prevent a point of discharge. The top of the level spreader must be horizontal and at an appropriate height to provide sheet flow directly to the soil without scour. Grade boards can be made of any material that will withstand weather and solar degradation. Trenches used as level spreaders can be open or filled with washed crushed rock, pea gravel, or sand
8. Check dams: shall be placed according to facility design otherwise:
  - a. Equal to the width of the filter
  - b. Every 10' where slope exceeds 5%.



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DEPARTMENT OF PUBLIC WORKS  
ENGINEERING DIVISION

FILTER STRIP  
  
TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



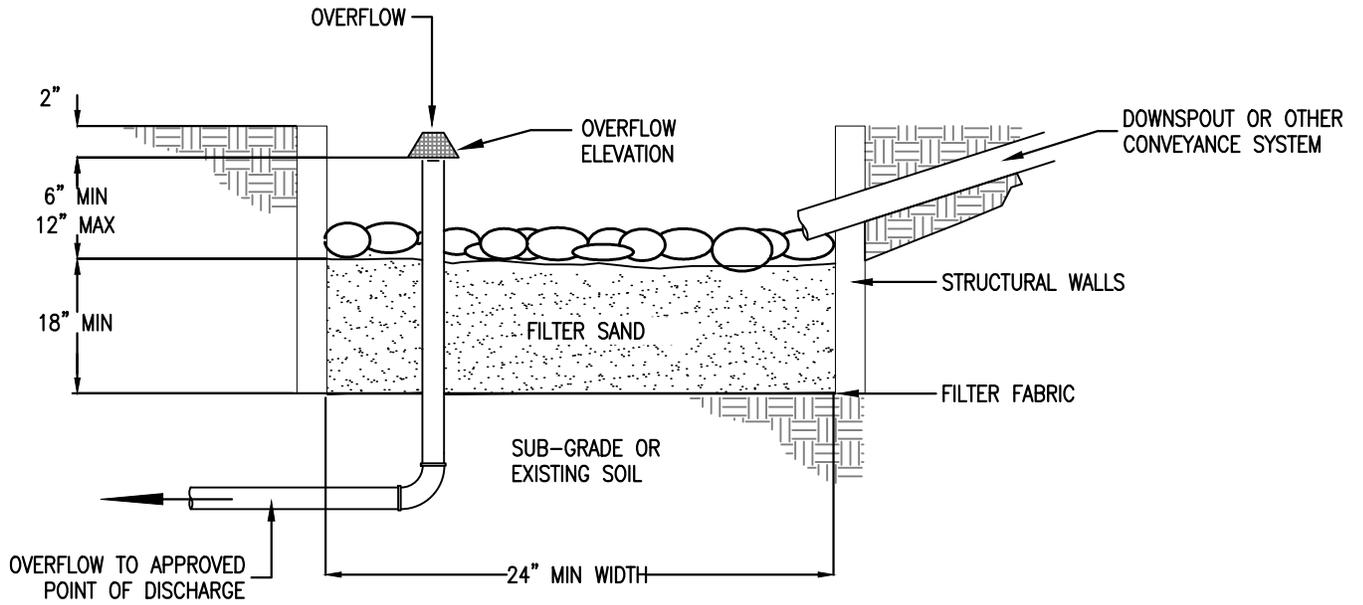
1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
  - a. Width: 24" minimum.
  - b. Depth: 6" minimum
  - c. Slope: 0.5% or less
3. Setbacks (from centerline of f):
  - a. Infiltration sand filters must be 10' from foundations and 5' from property lines. Filtration sand filters do not have setbacks with an approved waterproof liner.
4. Overflow:
  - a. Overflows are required to an approved point of discharge.
  - b. Inlet elevation must allow for 2" of freeboard, minimum.
5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.
6. Drain rock (minimum): 12" minimum of 3/4" - 2-1/2" washed.
7. Separation between drain rock: Drain rock shall be separated from sand layer and surrounding sold by a geotextile filter fabric
8. Filter sand:
  - a. 18" minimum.
  - b. See sand specification in SWMM.
9. Sand filter walls:
  - a. Material shall be stone, brick, concrete, wood, or other durable material (no chemically treated wood).
  - b. Filter walls built into foundation walls shall be shown on building plans.
10. Waterproof liner (where required): Shall be 30 mil PVC or equivalent.
11. Install washed pea gravel or river rock to transition from inlet or splash pad to growing medium.



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ENGINEERING DIVISION

FILTRATION SAND FILTER  
  
TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
2. Dimensions:
  - a. Width: 24" minimum
  - b. Depth: 6" minimum
  - c. Slope: 0.5% or less.
3. Setbacks:
  - a. Infiltration sand filters must be 10' from foundations and 5' from property lines.
  - b. Flow-through sand filters must be less than 30" in height above surrounding area if within 5 feet of property line.
4. Overflow (where required):
  - a. Overflow required for Simplified Approach.
  - b. Inlet elevation must allow for 2" of freeboard, minimum.
  - c. Protect from debris, sand, and sediment with strainer or grate.
5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.
6. Filter sand:
  - a. 18" minimum.
  - b. See sand spec in SWMM Exhibit 2-4.
9. Sand filter walls:
  - a. Material shall be stone, brick, concrete, wood, or other durable material (no chemically treated wood).
  - b. Concrete, brick, or stone walls shall be included on foundation plans.
10. Install washed pea gravel or river rock to transition from inlet or splash pad to growing medium.

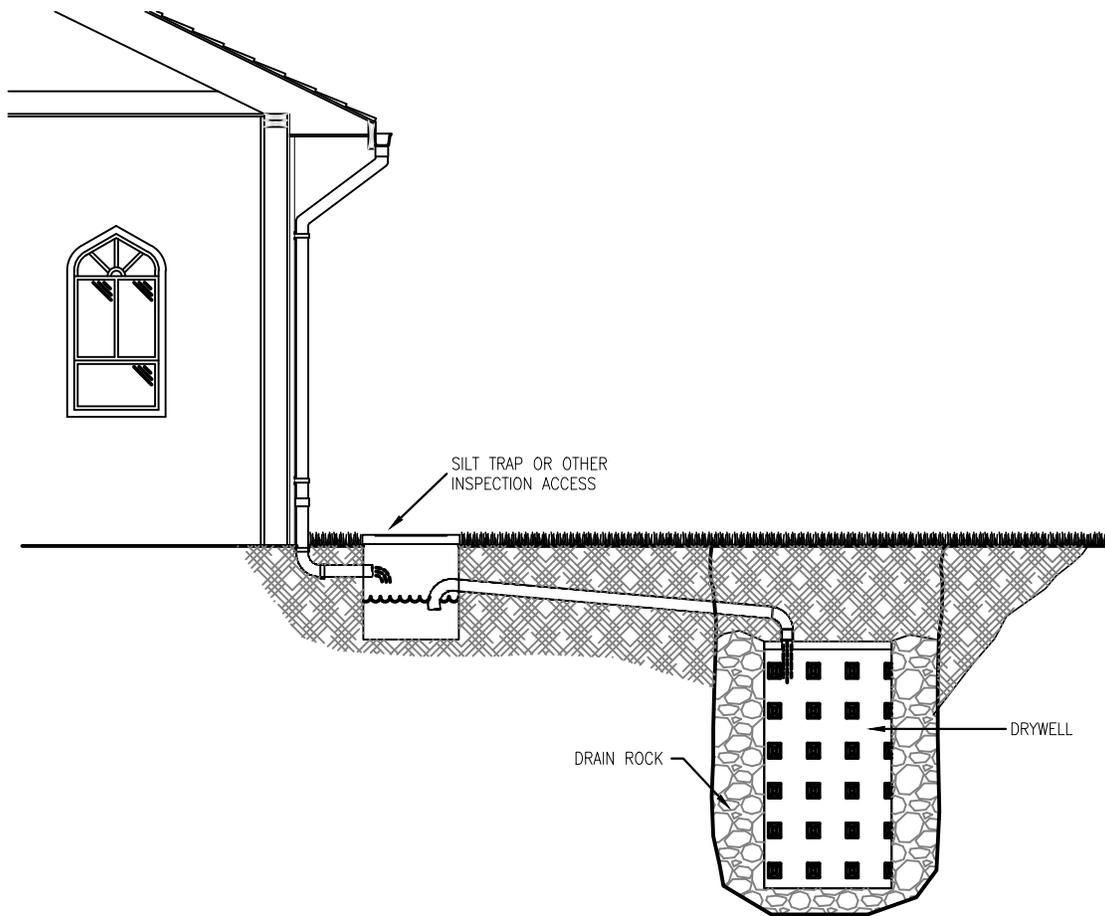


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DEPARTMENT OF PUBLIC WORKS  
ENGINEERING DIVISION

INFILTRATION SAND FILTER

TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



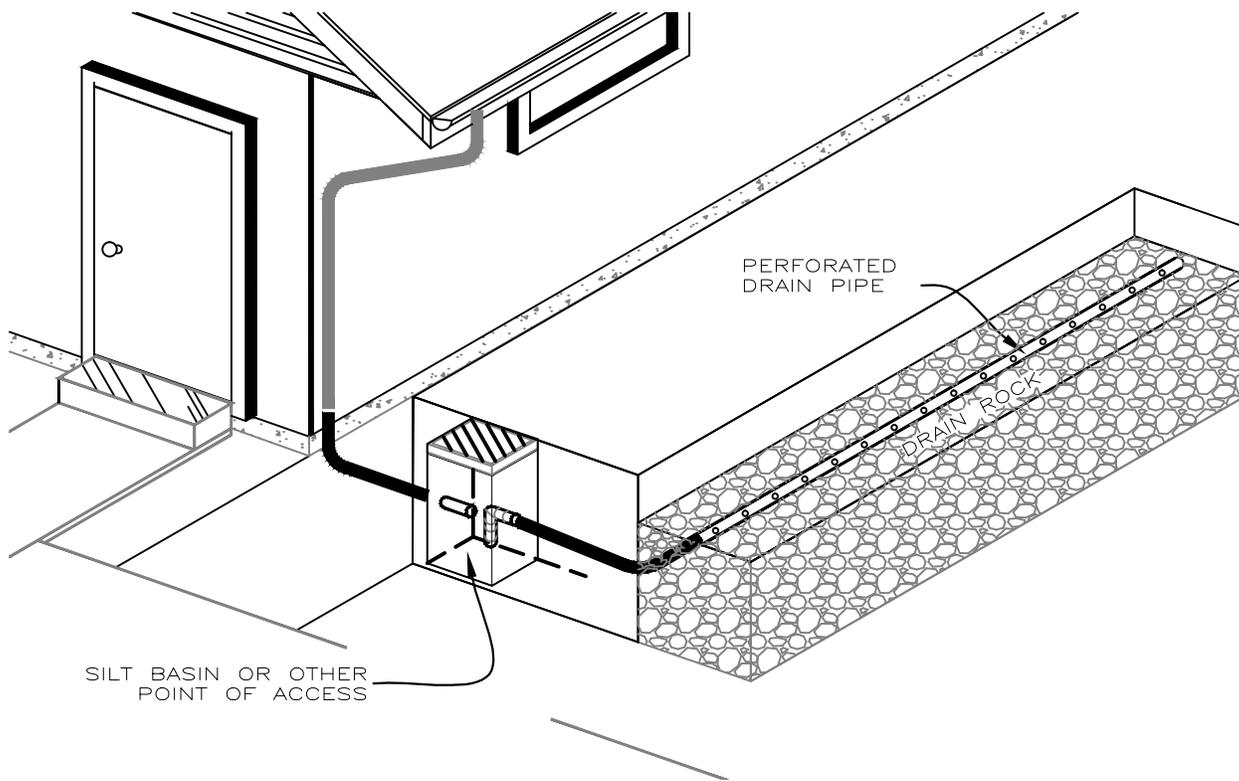
1. All drywells are considered Class 5 injection wells and must be registered with the Oregon Department of Environmental Quality as Underground Injection Control (UIC) systems.
2. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
3. Drywells shall be designed using the presumptive approach due to the limited soil conditions in Eugene and the need to fully infiltrate the flood control design storm. This detail is intended to illustrate a typical drywell installation. Installation shall conform to the drywell design provided by the Presumptive Method.
4. Setbacks (from center of facility):
  - a. 10' from foundations
  - b. 5' from property lines
5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.
6. Silt Traps: A silt trap or other access point is required at finished grade for inspection and maintenance access



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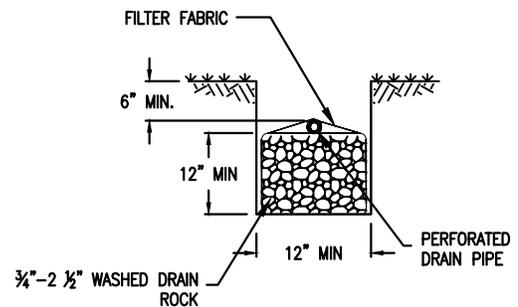
DRYWELL  
  
TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG



1. All soakage trenches are considered injection wells and must be registered with the Oregon Department of Environmental Quality as Underground Injection Control (UIC) systems.
2. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.
3. Soakage trenches shall be designed using the presumptive approach due to the limited soil conditions in Eugene and the need to fully infiltrate the flood control design storm. This detail is intended to illustrate a typical soakage trench installation. Installation shall conform to the soakage trench design provided by the Presumptive Method.
4. Setbacks (from center of facility):
  - a. 10' from foundations
  - b. 5' from property lines
5. Piping: Minimum 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping material, slopes and installation shall follow the Uniform Plumbing Code.
6. Silt Traps: A silt trap or other access point is required at finished grade for inspection and maintenance access

### SOAKAGE TRENCH TYPICAL CROSS SECTION



CITY OF  
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DEPARTMENT OF PUBLIC WORKS  
ENGINEERING DIVISION

SOAKAGE TRENCH  
TYPICAL DETAILS

DATE	1/2/2014
SCALE	NTS
DRAWN BY	SNG

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## **APPENDIX C**

### **FORMS**

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# SIM FORM: 2014 (Simplified Approach for Stormwater Management)

Application \_\_\_\_\_

Building Permit # \_\_\_\_\_

Address \_\_\_\_\_

Tax Lot # \_\_\_\_\_

Residential/Commercial

(Circle One)

NRCS Soil Type or  
Measured Infiltration Rate \_\_\_\_\_

## Facility Sizing

Total Proposed New or Replaced Impervious Surface Area \_\_\_\_\_ →  Box 1

### Impervious Area Reduction

Permeable Pavements \_\_\_\_\_ sf

Eco-Roof \_\_\_\_\_ sf

Contained Planter \_\_\_\_\_ sf

Tree Credit \_\_\_\_\_ sf

Total Impervious Area Reduction \_\_\_\_\_ →  Box 2

Total Impervious Area Requiring Stormwater Management \_\_\_\_\_ →  Box 3

(Box 1 - Box 2)

### Facility Sizing for Water Quality Only

Surface Facilities	Impervious Area Managed	Sizing Factor	Facility Surface Area
Rain Garden	_____ sf	x 0.05 =	_____
Stormwater Planter	_____ sf	x 0.03 =	_____
Swale	_____ sf	x 0.06 =	_____
Vegetated Filter Strip	_____ sf	x 0.2 =	_____
Sand Filter	_____ sf	x 0.03 =	_____

### Facility Sizing for Water Quality and Flow Control

Surface Facilities	Impervious Area Managed	Sizing Factor	Facility Surface Area
Rain Garden	_____ sf	x 0.11 =	_____
Stormwater Planter	_____ sf	x 0.07 =	_____
Sand Filter	_____ sf	x 0.07 =	_____

### Facility Sizing for Water Quality, Flow Control and Flood Control \*\*\* Only for use in Type A & B Soils

Surface Facilities	Impervious Area Managed	Sizing Factor	Facility Surface Area
Rain Garden	_____ sf	x 0.13 =	_____
Stormwater Planter	_____ sf	x 0.11 =	_____
Sand Filter	_____ sf	x 0.11 =	_____

Sum of Total  
Impervious Area Managed  Box 4

(Box 4 must be equal or greater than Box 3)

Point of Discharge (check one)

- Overflow to gutter (weephole)
- Overflow to public storm drain pipe
- Overflow to Open Drainage
- Subsurface Infiltration

**2014 SIM FORM: Tree Credit and Rainwater Harvesting Worksheet**

See "Tree Credits" section for more information regarding the use of trees to meet Stormwater Impervious Area Reduction.

**New Evergreen Trees**

To receive Impervious Area Reduction Credit, new evergreen trees must be planted within 25 feet of the new or replaced impervious surfaces. New trees cannot be credited against rooftop areas. Minimum tree height **(at the time of planting)** to receive credit is 6 feet

Enter number of new evergreen trees that meet qualification requirements in Box A


Box A

**Multiply Box A by 200 and enter result in Box B**

Box B

**New Deciduous Trees**

To receive Impervious Area Reduction Credit, new large deciduous trees must be planted within 25 feet of the new or replaced impervious surfaces and new small deciduous trees must be planted within 10 feet of new or replaced impervious surfaces. New trees cannot be credited against rooftop areas. Minimum tree caliper **(at the time of planting)** to receive credit is 2 inches.

Enter number of new deciduous trees that meet qualification requirements in Box C


Box C

**Multiply Box C by 100 and enter result in Box D**

Box D

**Existing Tree Canopy**

To receive Impervious Area Reduction Credit, existing large tree canopies must be within 25 feet and existing small tree canopies must be within 10 feet of ground-level impervious surfaces (cannot be credit against roof top surfaces). Existing tree canopy credited towards Impervious Area Reduction must be preserved during and after construction throughout the life of the development. Minimum tree caliper to receive credit is 4 inches. No credit will be given to existing tree canopy located within environmental conservation areas.

Enter square footage of existing tree canopy that meet qualification requirements in Box E.


Box E

Multiply Box E by 0.5 and enter result in Box F.

Box F

**Total Tree Credit**

Add Boxes B, D and F and enter the result in Box G


Box G

Multiply Box 1 of Form SIM by 0.1 and enter the result in Box H.

Box H

Enter the lesser of Box G and H in Box I. (This is the amount to be entered as "Tree Credit" on Form SIM.)

--

Box I

**SIM FORM 2014 Instructions**

1. Enter square footage (sf) of total impervious area being developed into BOX 1.
2. Enter square footage (sf) for impervious area reduction techniques.
3. Enter sum of the impervious area reduction techniques into BOX 2.
4. Subtract BOX 2 from BOX 1 to find BOX 3, the amount of impervious area that requires stormwater management.
5. Select appropriate stormwater management facilities.
6. Enter the square footage of impervious area managed that will flow into each facility type.
7. Multiply each impervious area managed by the corresponding sizing factor. Enter this area as the facility surface area, This is the size of facility required to manage runoff
9. Where selecting facilities that will overflow, select the point of discharge location.
10. Enter the sum of the total of all the impervious area managed into BOX 4. BOX 4 must be greater than or equal to BOX 3.

After Recording Return To:  
Name:  
Address:

Place Label Recording Here

## Notice of Operation and Maintenance Plan

The undersigned owner(s), hereby gives notice that stormwater runoff from impervious surfaces constructed on the premises described below require stormwater management facilities located, design and constructed in compliance with The City of Eugene’s Stormwater Management Manual.; and shall be operated and maintained in accordance with the “Operations and Maintenance Plan” to be placed on file with the City of Eugene.

References are made to said plan for all terms, conditions, provisions and particulars thereof which are hereby incorporated by reference as though fully set forth herein.

The requirement to operate and maintain this facility in accordance with the on-file Operations & Maintenance Plan is binding on all current and future owners of the property. The Operations & Maintenance Plan may be modified under written consent of new owners with written approval by and re-filing with the City. The Operations & Maintenance Plan for facilities constructed pursuant to this notice are available at the Eugene Public Works Department, located at 1820 Roosevelt, Eugene, Oregon, between the hours of 8 a.m. and 5 p.m., Monday through Friday. Call (541)682-4800.

The on-going operational, maintenance and financial responsibility of the stormwater facility(ies) shall be the responsibility of (*check one*).

- Homeowner’s Association       Property Owner Account
- Other (*described*) \_\_\_\_\_

The Subject premises, is legally described as follows:  
(Map and taxlot numbers are not legal descriptions)

This instrument is intended to be binding upon the parties hereto, their heirs, successors and assigns.

In Witness whereof, the undersigned has executed this instrument on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

Owner(s):

Signature \_\_\_\_\_  
Print name \_\_\_\_\_

STATE OF OREGON,  
County of Lane, ss:

This instrument was acknowledged before me this \_\_\_\_\_ day of \_\_\_\_\_  
20\_\_\_\_\_ by \_\_\_\_\_, Owner(s) of the  
above described premises.

\_\_\_\_\_  
Notary Public For Oregon

\_\_\_\_\_  
My Commission Expires

**FORM O & M: OPERATIONS & MAINTENANCE PLAN  
REQUIRED IN ACCORDANCE WITH THE CITY CODE**

Project Building Application No. \_\_\_\_\_

Owner's Name: \_\_\_\_\_

Phone No. \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Site Address: \_\_\_\_\_

Site Map and Tax lot No. \_\_\_\_\_

**Requirements**

- 1) Stormwater Management Site Plan, (min. 8 1/2" x 11" attached to this form) showing the location of the facility(ies) in relation to building structures or other permanent monuments on the site, sources of runoff entering the facility(ies), and where stormwater will be discharged to after leaving the facility(ies).

The stormwater management facility(ies) shown on the site plan are a required condition of building permit approval for the identified property. The owner of the identified property is required to operate and maintain the facility(ies) in accordance with the Operations and Maintenance (O&M) Plan on file with the City. The O&M Plan for the facility(ies) is/are available at the Public Works Department, located at 1820 Roosevelt, Eugene, Oregon between the hours of 8 a.m. and 5 p.m., Monday through Friday. Call (541)(682-4800).

- 2) Description of the financial method used to cover future operations and maintenance. *Check One*

Homeowner's Association       Property Owner Account

Other (*described*) \_\_\_\_\_

- 3) Party(ies) responsible for maintenance (only if other than owner).

Daytime Phone no. (\_\_\_\_) \_\_\_\_-\_\_\_\_

Emergency/After-hours contact phone no. (\_\_\_\_) \_\_\_\_-\_\_\_\_

Maintenance Contact party(ies) Name & Address:

- 
- 4) Maintenance practices and schedule for the stormwater facility is included in the facility-specific O&M Plan filed with the Public Works Department, City of Eugene. The operation and maintenance practices are based on the publication date of the City of Eugene's Stormwater Management Manual.

Preparation Date: \_\_\_\_\_, 20\_\_

Revision Date: \_\_\_\_\_, 20\_\_

Estimated Date of Installation \_\_\_\_\_, 20\_\_

By signing below, filer accepts and agrees to the terms and conditions contained in the operations & maintenance plan and in any document executed by filer and recorded with it.

Signature of Filer: \_\_\_\_\_

Print Name: \_\_\_\_\_

# STORMWATER MANAGEMENT FACILITY INSPECTION & MAINTENANCE LOG

Property Address:

Inspection Date:

Inspection Time:

Inspected By:

Type of Stormwater Management Facility:

Location of Facility on Site (In relation to buildings or other permanent structures):

Water levels and observations (ponded water, Oil sheen, smell, etc.):

(Approximate Date/Time of Last Significant Rainfall):

Sediment accumulation & areas of erosion. Record sediment removal/erosion repair:

What is the current condition of vegetation? Record survival rates, invasive species present, number of dead plants, etc.) Record any replacement plants and type of vegetation management (mowing, weeding, etc.)

What is the condition of physical properties such as inlets, outlets, piping, fences, and irrigation facilities? Record maintenance performed and replacement activities:

Presence of insects or damage from animals. Record control activities:

Identify safety hazards present. Record resolution activities:

# DISCHARGE AUTHORIZATION REQUEST

## for Source Control(s)

Discharge Authorizations are required for source controls in areas that have site characteristics and facility uses that have activities at risk for source point pollutant releases that are regulated or prohibited by local, state and federal regulations.

*NOTE: A separate Authorization shall be filled out for each activity area, and Special Requests are available on the second page of this form.*

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### GENERAL INFORMATION (to be completed for all Discharge Authorization Requests)

Applicant's Name: \_\_\_\_\_ Date: \_\_\_\_\_

Facility Name: \_\_\_\_\_ Owner/Operator Name: \_\_\_\_\_

Facility Address: \_\_\_\_\_

Business Mailing Address: \_\_\_\_\_

Phone No.: \_\_\_\_\_ Type of business/facility: \_\_\_\_\_

Building Permit No. (if applicable): \_\_\_\_\_

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### SOURCE CONTROL INFORMATION

Installation of Source Control(s) are a result of:

- Tenant Improvements to an existing facility and/or building.
- New Development of a site or property that was unimproved.
- Re-Development of a site or property that had prior uses.
- Code Compliance in response to local, state or federal notification.
- Other: \_\_\_\_\_

**Proposed Source Control(s) (check all that apply):**

- |  |  |
|--|--|
| <input type="checkbox"/> Oil/Water Separator             | <input type="checkbox"/> Containment Area                    |
| <input type="checkbox"/> Dock Leveler Pit with Retrofit  | <input type="checkbox"/> Sedimentation Manhole with Retrofit |
| <input type="checkbox"/> Wall Valve for Containment Area | <input type="checkbox"/> Discharge Line Shut-Off Valve       |
| <input type="checkbox"/> Collection Device/ Structure    | <input type="checkbox"/> Cooling Towers                      |
| <input type="checkbox"/> Other: _____                    | <input type="checkbox"/> Other: _____                        |

*[NOTE: Additional City approved "Standard Maintenance" appendices will be required for each Source Control listed above, or provide a vendor's Maintenance document (if available). Contact PW at 541-682-5291 for applicable appendices.]*

Describe the site activity (ies) the source control(s) apply to:

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**Attach a site plan with the location of the Source Control.** Be sure to identify the location in reference to a permanent structure, for assistance in field verification. *(A hand-drawn sketch, not to scale, is acceptable as long as it is legible.)*

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**SPECIAL REQUEST (check only if applicable)**

- Request to remove or abandon existing source control(s).
- Request to propose alternative source control(s).
- Request to ADJUST source control requirement(s).
- Request for review of ADJUSTMENT qualifications.

Please provide a brief explanation (Use additional pages if necessary.):

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**TO BE COMPLETED BY CITY:**

- Approved  Denied

Date: \_\_\_\_\_ Signature: \_\_\_\_\_ Dept.: \_\_\_\_\_

Comments: \_\_\_\_\_

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**APPENDIX D**

**FACILITY PLANTING DESIGN**

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APPENDIX D

PLANTING OPTIONS  
CITY OF EUGENE

Scientific Name	Common Name	Facility Planting Options					Plant Categories					Planting Zones		
		Grassy Swales	Vegetated Swales / Filter Strips	Stormwater Planters	Rain Gardens / Dry Detention Ponds	Wet / Extended Wet Ponds	Ground Cover Plants	Small Shrubs	Large Shrubs	Deciduous Tree	Evergreen Tree	Planting Zone A (wet to moist)	Planting Zone B (moist to dry)	Approved Street Tree Options
*approved for public rights of way														
<i>Abies grandis</i>	Grand Fir									◆		◆		
<i>Abies koreana</i>	Silver Korean fir									◆		◆	◆	
<i>Abies lasiocarpa</i>	Rocky Mountain fir									◆		◆	◆	
<i>Acer circinatum</i>	Vine Maple							◆			◆	◆		
<i>Acer ginnala</i>	Amur Maple								◆			◆	◆	
<i>Acer glabrum var. douglasii</i>	Rocky Mountain Maple								◆			◆	◆	
<i>Acer griseum</i>	Paperbark Maple								◆			◆	◆	
<i>Acer macrophyllum</i>	Big leaf Maple								◆			◆		
<i>Agrostis exarata</i>	Spike Bentgrass						◆				◆			
<i>Alisma plantago-aquatica</i>	Water Plantain						◆				◆			
<i>Allium acuminatum</i>	Hooker's Onion						◆				◆			
<i>Allium amplexans</i>	Slim Leaf Onion						◆				◆			
<i>Alnus rhombifolia</i>	White Alder								◆			◆	◆	
<i>Alnus rubra</i>	Red Alder								◆			◆	◆	
<i>Alopecurus geniculatus</i>	Water Foxtail						◆				◆			
<i>Amelanchier alnifolia</i>	Western Saskatoon Serviceberry								◆			◆	◆	
<i>Amelanchier grandiflora</i>	Autumn Brilliance & Forest Prince								◆			◆	◆	
<i>Arbutus menziesii</i>	Pacific Madrone								◆			◆	◆	
<i>Arbutus unedo</i>	Strawberry Madrone								◆			◆	◆	
<b><i>Arctostaphylos uva-ursi</i>*</b>	<b>Kinnikinnick</b>						◆					◆		
<i>Aster hallii</i>	Hall's Aster						◆					◆		
<i>Aster subspicatus</i>	Douglas' Aster						◆					◆		
<i>Athyrium felix-femina</i>	Lady Fern						◆					◆		
<i>Beckmannia syzigachne</i>	American Slough Grass						◆				◆			
<i>Betula nigra 'Heritage'</i>	Heritage River Birch								◆			◆	◆	
<i>Bidens cernua</i>	Nodding Beggarticks						◆				◆			
<i>Blechnum spicant</i>	Deer Fern						◆				◆			

Scientific Name	Common Name	Facility Planting Options					Plant Categories				Planting Zones		Approved Street Tree Options
		Grassy Swales	Vegetated Swales / Filter Strips	Stormwater Planters	Rain Gardens / Dry Detention Ponds	Wet / Extended Wet Ponds	Ground Cover Plants	Small Shrubs	Large Shrubs	Deciduous Tree	Evergreen Tree	Planting Zone A (wet to moist)	
*approved for public rights of way													
<i>Brodiaea congesta</i>	Harvest Brodiaea						◆				◆		
<i>Bromus carinatus</i>	California Brome Grass						◆				◆		
<i>Bromus sitchensis</i>	Alaska Brome	◆					◆				◆		
<i>Bromus vulgaris</i>	Columbia Brome Grass						◆				◆		
<i>Calocedrus decurrens</i>	Incense Cedar								◆			◆	◆
<i>Camassia quamash</i>	Common Camas	◆					◆				◆	◆	
<b>Carex densa*</b>	<b>Dense Sedge</b>						◆				◆		
<i>Carex deweyanna</i>	Dewey Sedge						◆				◆		
<i>Carex hendersonii</i>	Henderson Hedge						◆				◆		
<b>Carex obnupta*</b>	<b>Slough Sedge</b>						◆				◆		
<b>Carex stipata*</b>	<b>Sawbeak Sedge</b>						◆				◆		
<b>Carex tumulicola*</b>	<b>Foothill Sedge</b>						◆				◆		
<i>Carpinus betulus</i>	European Hornbeam								◆			◆	◆
<i>Ceanothus cuneatus</i>	Buckbrush							◆			◆		
<i>Ceanothus integerrimus</i>	Deerbrush							◆				◆	
<i>Ceanothus sanguineus</i>	Oregon Redstem Ceanothus	◆						◆				◆	
<i>Ceanothus velutinus</i>	Snowbrush	◆						◆				◆	
<i>Celtis occidentalis</i>	Common Hackberry	◆							◆		◆	◆	◆
<i>Celtis reticulata</i>	Netleaf Hackberry	◆							◆			◆	◆
<i>Chilopsis linearis</i>	Desert Willow	◆							◆			◆	◆
<i>Chitalpa taskhentensis</i>	Pink Dawn Chitalpa	◆							◆			◆	◆
<i>Clarkia amoena</i>	Summer's Darling						◆					◆	
<i>Clarkia purpurea</i>	Four Spot Godetia						◆					◆	
<i>Collomia grandiflora</i>	Large Leaf Collomia	◆					◆					◆	
<b>Cornus kelseyii*</b>	<b>Kelseyi Dogwood</b>							◆			◆	◆	
<i>Cornus nuttallii</i>	Western Flowering Dogwood	◆							◆			◆	◆
<i>Cornus stolonifera</i>	Red-osier Dogwood	◆						◆			◆	◆	
<i>Corylus cornuta</i>	Western Beaked Hazelnut	◆						◆					
<i>Crataegus douglasii</i>	Black Hawthorn							◆			◆		
<i>Cupressus arizonica</i>	"Blue Ice" Arizona cypress	◆										◆	◆
<i>Cupressus bakeri</i>	Modoc cypress								◆				◆
<b>Daffodil*</b>	<b>Daffodil</b>						◆					◆	
<i>Danthonia californica</i>	California Oatgrass						◆				◆		

Scientific Name	Common Name	Facility Planting Options					Plant Categories					Planting Zones		Approved Street Tree Options	
		Grassy Swales	Vegetated Swales / Filter Strips	Stormwater Planters	Rain Gardens / Dry Detention Ponds	Wet / Extended Wet Ponds	Ground Cover Plants	Small Shrubs	Large Shrubs	Deciduous Tree	Evergreen Tree	Planting Zone A (wet to moist)	Planting Zone B (moist to dry)		
*approved for public rights of way															
<i>Deschampsia caespitosa</i>	Tufted Hairgrass						◆					◆	◆		
<i>Deschampsia elongata</i>	Slender Hairgrass						◆					◆			
<i>Dichelostemma congestum</i>	Ookow	◆					◆					◆			
<i>Downingia elegans</i>	Calico Flower						◆					◆			
<i>Eleocharis acicularis</i>	Needle Spike-rush						◆					◆			
<i>Eleocharis ovata</i>	Ovate Spike-rush	◆					◆					◆			
<i>Eleocharis palustris</i>	Creeping Spike-rush						◆					◆			
<i>Elymus glaucus</i>	Blue Wildrye						◆					◆			
<i>Elymus trachycaulus</i>	Slender Wheatgrass						◆					◆			
<i>Epilobium densiflora</i>	Dense Spike Primrose	◆					◆					◆			
<i>Eriophyllum lanatum</i>	Oregon Sunshine						◆					◆			
<b><i>Euonymus altus*</i> (Need water)</b>	<b>Dwarf Euonymus</b>							◆					◆		
<i>Festuca occidentali</i>	Western Fescue Grass						◆					◆			
<i>Festuca roemeri</i> var. <i>roemeri</i>	Roemer's Fescue	◆					◆					◆			
<i>Festuca rubra</i> var. <i>commutata</i>	Western Red Fescue						◆						◆		
<b><i>Fragaria chiloensis*</i></b>	<b>Beach or Chilean strawberry</b>	◆					◆						◆		
<i>Fragaria vesca</i> ( <i>virginiana</i> )	Wild Strawberry	◆					◆						◆		
<i>Fraxinus latifolia</i>	Oregon Ash	◆								◆		◆	◆		◆
<i>Gaultheria shallon</i>	Salal							◆					◆		
<i>Ginkgo biloba</i>	Ginko	◆								◆			◆		◆
<i>Glyceria occidentalis</i>	Western Manna Grass	◆					◆					◆			
<i>Grindelia intergrifolia</i>	Gumweed						◆								
<b><i>Helictotrichon sempervirens*</i></b>	<b>Blue Oat Grass</b>						◆						◆		
<i>Holodiscus discolor</i>	Oceanspray	◆							◆				◆		
<i>Hordeum brachyantherum</i>	Meadow Barley						◆								
<i>Idesia polycarpa</i>	Chinese Wonder Tree									◆			◆		◆
<b><i>Iris douglasiana*</i></b>	<b>Douglas Iris</b>						◆						◆		
<b><i>Iris tenax*</i></b>	<b>Oregon Iris</b>						◆						◆		
<b><i>Juncus acuminatus*</i></b>	<b>Tapertip Rush</b>						◆					◆			
<b><i>Juncus effusus</i> var. <i>gracilis*</i></b>	<b>Common / Soft Rush</b>						◆					◆			
<b><i>Juncus effusus</i> var. <i>pacificus*</i></b>	<b>Common Rush</b>						◆					◆			
<b><i>Juncus ensifolius*</i></b>	<b>Dagger-leaf Rush</b>						◆					◆			
<i>Juncus oxymeris</i>	Pointed Rush	◆					◆					◆			

Scientific Name	Common Name	Facility Planting Options					Plant Categories					Planting Zones		Approved Street Tree Options
		Grassy Swales	Vegetated Swales / Filter Strips	Stormwater Planters	Rain Gardens / Dry Detention Ponds	Wet / Extended Wet Ponds	Ground Cover Plants	Small Shrubs	Large Shrubs	Deciduous Tree	Evergreen Tree	Planting Zone A (wet to moist)	Planting Zone B (moist to dry)	
*approved for public rights of way														
<b>Juncus patens*</b>	<b>Grooved Rush; Spreading Rush</b>						◆				◆			
<i>Juncus tenuis</i>	Slender Rush						◆				◆			
<i>Juncus unilateralis</i>	One-sided Rush						◆				◆			
<i>Koeleria macrantha</i>	Junegrass						◆							
<i>Koelreuteria paniculata</i>	Goldenrain Tree								◆		◆	◆		◆
<i>Lagerstroemia indica</i>	Crepemyrtle								◆			◆		◆
<i>Lemna minor</i>	Common Lesser Duckweed													
<i>Lonicera involucrata</i>	Black Twinberry							◆				◆		
<i>Lupinus micranthus</i>	Small Flowered Lupine						◆					◆		
<i>Lupinus polyphyllus</i>	Large Leaf Lupine						◆				◆	◆		
<i>Lupinus rivularis</i>	Riverbank Lupine						◆							
<i>Madia elegans</i>	Showy Tarweed						◆							
<i>Mahonia aquifolium</i>	Tall Oregon Grape							◆				◆		
<b>Mahonia nervosa*</b>	<b>Dull Oregon Grape</b>							◆				◆		
<b>Mahonia repens*</b>	<b>Creeping Oregon Grape</b>							◆				◆		
<i>Malus fusca</i>	Pacific Crab Apple								◆		◆			
<i>Myosotis laxa</i>	Small-flowered Forget-me-not													
<b>Nandina domestica*</b>	<b>Dwarf Nandina (Heavenly Bamboo)</b>						◆					◆		
<i>Nyssa sylvatica</i>	Canyon Live Oak									◆		◆		◆
<i>Oemleria cerasiformis</i>	Indian Plum									◆		◆		◆
<i>Olea europea</i>	Wilsonii fruitless olive									◆		◆		◆
<i>Parrotia persica</i>	Persian Ironwood									◆		◆		◆
<i>Philadelphus lewisii</i>	Mock Orange								◆			◆		
<i>Physocarpus capitatus</i>	Pacific Ninebark								◆		◆	◆		
<i>Picea smithiana</i>	Morinda spruce										◆		◆	◆
<i>Pinus bungeana</i>	Lacebark Pine										◆		◆	◆
<i>Pinus monticola</i>	Western White Pine										◆			
<i>Pinus ponderosa</i>	Ponderosa Pine										◆			◆
<i>Pinus wallichiana</i>	Himalayan Pine													◆
<i>Pistacia persica</i>	Chinese Pistache													◆
<i>Plagiobothrys figuratus</i>	Popcorn Flower						◆							
<b>Polystichum munitum*</b>	<b>Sword Fern</b>						◆				◆	◆		
<i>Populus balsamifera</i>	Black Cottonwood								◆			◆		

Scientific Name	Common Name	Facility Planting Options					Plant Categories				Planting Zones		Approved Street Tree Options
		Grassy Swales	Vegetated Swales / Filter Strips	Stormwater Planters	Rain Gardens / Dry Detention Ponds	Wet / Extended Wet Ponds	Ground Cover Plants	Small Shrubs	Large Shrubs	Deciduous Tree	Evergreen Tree	Planting Zone A (wet to moist)	
*approved for public rights of way													
<i>Populus tremuloides</i>	Quaking Aspen								◆			◆	◆
<i>Potamogeton natans</i>	Floating-leafed Pondweed												
<i>Potentilla gracilis</i> var. <i>gracilis</i>	Graceful Cinquefoil						◆					◆	
<i>Prunella vulgaris</i> var. <i>vulgaris</i>	Heal All						◆						
<i>Prunus emarginata</i>	Choke Cherry							◆					
<i>Pseudotsuga menziesii</i>	Douglas Fir								◆			◆	
<i>Pteridium aquilinum</i>	Bracken Fern						◆					◆	
<i>Quercus bicolor</i>	Swamp White Oak								◆			◆	◆
<i>Quercus chrysolepis</i>	Canyon Live Oak								◆			◆	◆
<i>Quercus douglasii</i>	Blue Oak								◆			◆	◆
<i>Quercus engelmannii</i>	Engelmann Oak								◆			◆	◆
<i>Quercus frainetta</i> 'Schmidt'	Forest Green Hungarian Oak								◆			◆	◆
<i>Quercus garryana</i>	Oregon White Oak								◆			◆	◆
<i>Quercus imbricaria</i>	Shingle Oak								◆			◆	◆
<i>Quercus kelloggii</i>	California Black Oak								◆			◆	◆
<i>Quercus lobata</i>	Valley Oak								◆			◆	◆
<i>Quercus shumardii</i>	"Southern Plains" Shumard Oak								◆		◆	◆	◆
<i>Quercus suber</i>	Cork Oak								◆			◆	◆
<i>Quercus virginiana</i>	"Cathedral" Southern Live Oak								◆		◆	◆	◆
<i>Ranunculus occidentalis</i>	Western Buttercup						◆						
<i>Rhamnus purshiana</i>	Cascara Buckthorn								◆		◆	◆	◆
<i>Ribes sanguineum</i>	Red-Flowering Current							◆				◆	
<i>Rosa gymnocarpa</i>	Baldhip Rose							◆				◆	
<i>Rosa nutkana</i>	Nootka Rose							◆				◆	
<i>Rosa pisocarpa</i>	Swamp Rose							◆			◆	◆	
<b><i>Rubus calycinoides</i>*</b>	<b>Creeping Bramble</b>						◆					◆	
<i>Rubus parviflorus</i>	Thimbleberry							◆			◆		
<b><i>Rubus pentalobus</i>*</b>	<b>Creeping Rubus</b>						◆					◆	
<i>Rubus spectabilis</i>	Salmonberry							◆			◆		
<i>Sagittaria latifolia</i>	Broadleaf Arrowhead												
<i>Salix fluviatilis</i>	Columbia Willow								◆		◆	◆	
<i>Salix hookeriana</i>	Hookers Willow								◆		◆	◆	

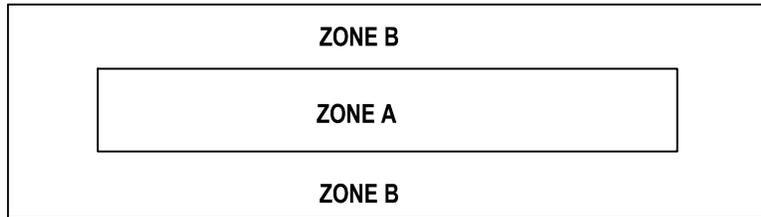
Scientific Name	Common Name	Facility Planting Options				Plant Categories				Planting Zones		Approved Street Tree Options
		Grassy Swales	Vegetated Swales / Filter Strips	Stormwater Planters	Rain Gardens / Dry Detention Ponds Wet / Extended Wet Ponds	Ground Cover Plants	Small Shrubs	Large Shrubs	Deciduous Tree	Evergreen Tree	Planting Zone A (wet to moist)	
*approved for public rights of way												
<i>Salix lucida</i>	Pacific Willow							◆		◆		
<i>Salix scouleriana</i>	Scouler's Willow							◆		◆	◆	
<i>Salix sessilifolia</i>	Soft leafed Willow							◆		◆		
<i>Salix sitchensis</i>	Sitka Willow							◆		◆		
<i>Sambucus nigra cerulea</i>	Blue Elderberry							◆			◆	
<i>Sambucus racemosa</i>	Red Elderberry							◆			◆	
<i>Sciadopitys verticillata</i>	Japanese Umbrella pine								◆		◆	◆
<i>Scirpus americanus</i>	American Bulrush					◆				◆		
<i>Scirpus microcarpus</i>	Small Fruited Rush					◆				◆		
<i>Sedum oregonum</i>	Oregon Sedum					◆					◆	
<i>Sisyrinchium douglasii</i>	Purple-eyed Grass					◆						
<i>Sisyrinchium idahoense</i>	Blue-eyed Grass					◆						
<i>Sophora japonica</i>	Chinese Scholar Tree							◆			◆	◆
<i>Sparganium emersum</i>	Narrowleaf Burreed											
<i>Spirea betulifolia</i>	Shiny-leaf Spirea						◆			◆	◆	
<i>Spirea douglasii</i>	Douglas Spirea						◆			◆	◆	
<b>Spirea sp*</b>	<b>Dwarf Spirea</b>						◆				◆	
<i>Symphoricarpos albus</i>	Common Snowberry							◆			◆	
<i>Taxodium distichum</i>	Bald cypress								◆		◆	◆
<i>Thuja plicata</i>	Western Red Cedar								◆	◆		◆
<i>Tsuga canadensis</i>	Canadian hemlock								◆		◆	◆
<i>Tsuga mertensiana</i>	Mountain hemlock								◆		◆	◆
<i>Tsuga sieboldii</i>	Southern Japanese hemlock								◆		◆	◆
<i>Veronica americana</i>	American Speedwell											
<i>Viburnum edule</i>	Highbush Cranberry						◆			◆	◆	

**FACILITY PLANTING ZONES**

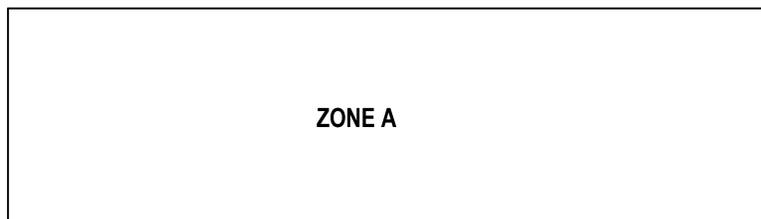
**Zone A:** Area of the facility defined as the bottom of the facility to the designated high water mark. This area has wet to moist soils and plants located here shall be tolerant of mild inundation.

**Zone B:** Area of the facility defined as the side slopes from the designated high water line up to the edge of the facility. This area typically has drier to moist soils with the moist soils being located farther down the side slopes. Plants here should be drought tolerant and help stabilize the slopes.

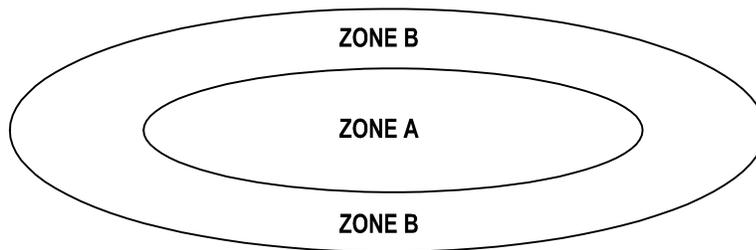
**SWALE PLANTING ZONES**



**PLANTER PLANTING ZONES**



**RAIN GARDEN PLANTING ZONES**



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**APPENDIX E**

**APPROVED PROPRIETARY  
STORMWATER TREATMENT TECHNOLOGIES**

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## **APPENDIX E**

### **APPROVED PROPRIETARY STORMWATER TREATMENT TECHNOLOGIES**

**City of Eugene**

**List Currently Approved as of November, 2013**

#### **OVERVIEW**

This document is a list of proprietary stormwater treatment technologies (devices) approved for use to meet the pollution reduction requirements of the City of Eugene Stormwater Management Manual.

#### **USE LEVEL DESIGNATIONS**

Approved proprietary stormwater treatment technologies are those devices approved to meet the target treatment goal of **Basic Treatment or Pre Treatment** at the **General Use Level Designation (GULD)** as defined by the 2011 Washington State Department of Ecology Technology Assessment Protocol – Ecology (TAPE). Devices shall be sized using the treatment flow rates defined below. The sizing the requirements are based upon flow rates identified in each proprietary stormwater treatment technologies GULD decision from the Washington State DOE.

#### **SUBMISSION OF ALTERNATE TECHNOLOGIES**

Manufacturers or designers wishing to submit proprietary stormwater treatment technologies for approval shall submit those technologies to the Washington State Department of Ecology. The City of Eugene does not test pollution reduction treatment technologies. Proprietary manufactured stormwater treatment technologies are approved for use within the City of Eugene based on Washington Department of Ecology (WashDOE) General Use Level Designation (GULD). Please see the Washington Department of Ecology website for more information on submission guidelines for new technologies:

<http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html>

#### **APPROVED TECHNOLOGIES FOR USE ON PRIVATE SYSTEMS**

All units shall be sized using the Presumptive Method. Devices shall be sized using the treatment flows rates for each model below. Bypass flow rates shall be per the manufacturer's specifications.

#### **Americast Filterra® System**

Filterra® stormwater treatment systems shall be sized using a filter hydraulic conductivity of 35.46 inches per hour.

### **Aqua Shield Aqua-Swirl®**

Aqua-Swirl® stormwater treatment systems shall be sized per manufactures maximum water quality design flow rates.

### **BaySaver Technologies, Inc. BayFilter®**

- BayFilter Cartridge (BFC) is limited to 30 GPM (0.067 CFS) per cartridge (43 sf filter area)
- Enhanced Media Cartridge (EMC) is limited to 45 GPM (0.1 CFS) per cartridge for 30-inch diameter cartridges (90 sf filter area) and 75 GPM (0.17 CFS) per cartridge for 39 inch diameter cartridges (150 sf filter area).
- Media combinations or the BayFilter cartridges are limited to Silica Sand, Perlite, Zeolite and Activated Alumina.

### **Contech Engineered Solutions Media Filtration System (MFS)**

- Filter media shall be Perlite
- The 12 inch filter cartridge is limited to a maximum water quality flow rate of 4.9 GPM per cartridge
- The 22 inch tall cartridge is limited to a maximum water quality flow rate of 9.0 GPM per cartridge

### **Contech Engineered Solutions Stormfilter using ZPG media**

- The 12 inch filter cartridge is limited to a maximum water quality flow rate of 5.0 GPM per cartridge
- The 18 inch filter cartridge is limited to a maximum water quality flow rate of 7.5 GPM per cartridge
- The 27 inch filter cartridge is limited to a maximum water quality flow rate of 11.3 GPM per cartridge

### **Contech Engineered Solutions CDS® Stormwater Treatment System**

CDS® stormwater treatment systems shall be sized per manufactures maximum water quality design flow rates.

### **Hydro International Downstream Defender**

Downstream Defender® stormwater treatment systems shall be sized per manufactures Maximum Treatment flow Rates for 50 microns (MFTR-50).

**Imbrium Stormceptor®**

Stormceptor STC® stormwater treatment systems shall be sized in accordance with the following Table.

Imbrium Stormceptor®	
Model	Maximum Water quality treatment flow rate (CFS)
STC 450i	0.32
STC 900	0.64
STC 1200	0.64
STC 1800	0.64
STC 2400	1.06
STC 3600	1.06
STC 4800	1.77
STC 6000	1.77
STC 7200	2.48
STC 11000	3.53
STC 13000	3.53
STC 16000	4.95

**Kristar Enterprises Flogard Perk Filter®**

- Filter media shall be zeolite-perlite-carbon (ZPC) filter media as specified by Kristar
- The 12 inch filter cartridge is limited to a maximum water quality flow rate of 6.8 GPM per cartridge
- The 18 inch tall cartridge is limited to a maximum water quality flow rate of 10.2 GPM per cartridge

**Royal Environmental Systems ecoStrom/ecoStorm plus Treatment Train**

The *ecostrom plus* system must be used in conjunction with an upstream *ecoStrom* unit as a treatment train. *ecoStrom plus* units shall use the standard concrete filter. *ecoStrom plus* units shall be sized at a maximum water quality design flow rate of 180 GPM (0.40 CFS) per 5 foot diameter filter (19.63 square foot surface area)

The upstream *ecoStrom* unit shall be sized in accordance with the following Table.

Royal Environmental System ecoStorm		
Model	Diameter	Maximum Water quality treatment flow rate GPM (CFS)
0.5	4	377 (0.84)
0.75	5	588 (1.31)
1	6	848 (1.89)
1.5	7	1,153 (2.57)
2	8	1,508 (3.36)
3	10	2,356 (5.25)
4	12	3,393 (7.57)

## **APPROVED TECHNOLOGIES FOR USE IN THE PUBLIC RIGHT-OF-WAY**

All units shall be sized using the Presumptive Method. Devices shall be sized using the minimum water quality treatment flows rates for each model below. All bypass flow rates shall be per the manufacturer's specifications.

### **Aquashield Aqua-Swirl®**

Aqua-Swirl stormwater treatment systems shall be sized per manufactures maximum water quality design flow rates.

### **Contech CDS® System**

CDS® stormwater treatment systems shall be sized per manufactures maximum water quality design flow rates.

### **Hydro International Downstream Defender®**

Downstream Defender® stormwater treatment systems shall be sized per manufactures Maximum Treatment flow Rates for 50 microns (MFTR-50).

### **Imbrium Systems Stormceptor STC®**

Stormceptor STC® stormwater treatment systems shall be sized in accordance with the following Table.

Imbrium Stormceptor®	
Model	Maximum Water quality treatment flow rate (CFS)
STC 450i	0.32
STC 900	0.64
STC 1200	0.64
STC 1800	0.64
STC 2400	1.06
STC 3600	1.06
STC 4800	1.77
STC 6000	1.77
STC 7200	2.48
STC 11000	3.53
STC 13000	3.53
STC 16000	4.95

## **APPENDIX F**

### **FLOW CONTROL STRUCTURES AND OUTFALL SIZING**

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## APPENDIX F

### CONTROL STRUCTURES FOR DETENTION SYSTEMS

This appendix presents the methods and equations for the design of flow control structures. It includes illustrations and equations for the design of orifices, rectangular sharp crested weirs and v-notch weirs.

Detention control structures shall be either weir structures or orifice structures. Weir structures may be enclosed in a catch basin, manhole, or vault, or may be installed in the open, provided they are accessible for maintenance and are not exposed to damage. Riser type restrictor devices also provide some incidental oil/water separation and spill control. Weir structures provide some oil/water separation when fitted with a baffle plate located upstream of the weir.

#### Orifices

- Orifices may be constructed on a pipe, “tee” riser, baffle, or other structure intended for conveyance.
- The minimum allowable diameter for an orifice used to control flows in a public facility is 2 inches. Private facilities may utilize a 1-inch diameter orifice if additional clogging prevention measures are implemented. The orifice diameter shall always be greater than the thickness of the orifice plate.
- Multiple orifices may be necessary to meet the flood control design storm performance for a detention system. However, extremely low flow rates may result in small orifices (< 2 inches) that are prone to clogging. In these cases, retention facilities that do not rely on orifice structures shall be used to the maximum extent practicable to meet flow control requirements. Large projects may also result in high flow rates that necessitate excessively large orifice sizes that are impractical to construct. In such cases, several orifices may be located at the same elevation to reduce the size of each individual orifice.

### Orifice Sizing Equation:

$$Q = CA \sqrt{2gh}$$

where:

Q = Orifice discharge rate, cfs

C = Coefficient of discharge, feet (suggested value = 0.60 for plate orifices)

A = Area of orifice, square feet

h = hydraulic head, feet

g = 32.2 ft/sec<sup>2</sup>

The diameter of plate orifices is typically calculated from the given flow. The orifice equation is often useful when expressed as an equivalent orifice diameter in inches.

$$d = \sqrt{\frac{36.88 Q}{\sqrt{h}}}$$

where:

Q = flow, cfs

d = orifice diameter, inches

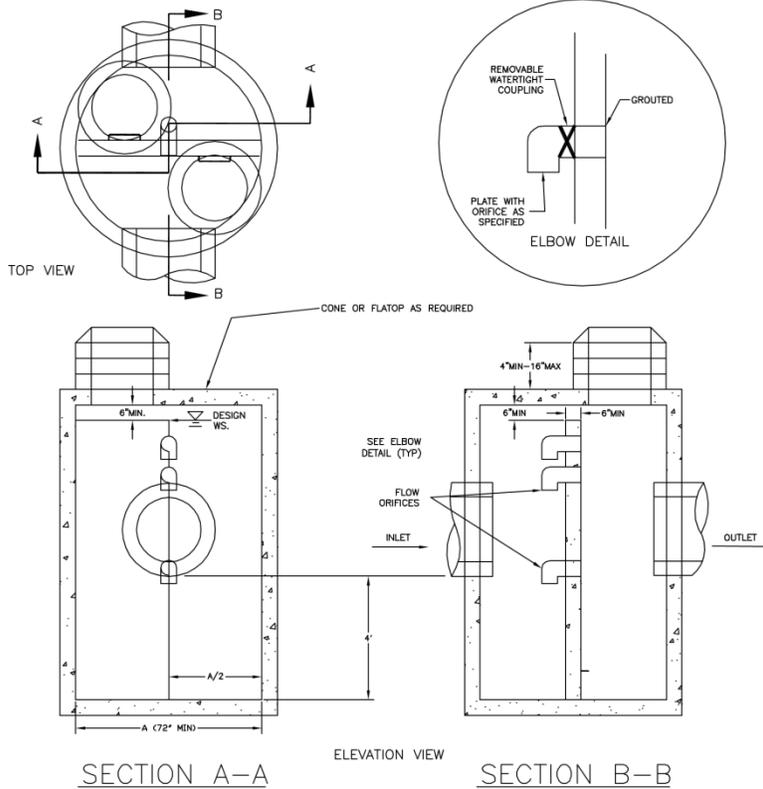
h = hydraulic head, feet

- Orifices shall be protected within a manhole structure, or by a minimum 18-inch-thick layer of 1½" to 3" evenly graded, washed rock. Orifice holes shall be externally protected by stainless steel or galvanized wire screen (hardware cloth) with a mesh of ¾" or less. Chicken wire shall not be used for this application.
- Orifice diameter shall be greater than or equal to the thickness of the orifice plate (see diagram).
- If less than 3", the orifice shall not be made of concrete. A thin material (e.g., stainless steel, HDPE or PVC) shall be used to make the orifice plate; the plate shall be attached to the concrete or structure.



NOTES

1. EXCEPT AS SHOWN OR NOTED, UNIT SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS FOR LARGE PRE CAST CONCRETE MANHOLES.
2. SEE PROJECT PLANS FOR SIZE AND LOCATION OF ORIFICES.
3. PIPE SIZES, SLOPES AND ALL ELEVATIONS AS SHOWN IN THE PLANS.
4. BAFFLE WALL SHALL HAVE #4 BAR AT 12" SPACING EACH WAY.
5. PRE CAST BAFFLE WALL SHALL BE KEYPED AND GROUTED IN PLACE.
6. ORIFICE PLATES TO BE 1/4" THICK MIN. HDPE OR APPROVED EQUAL AND ATTACHED WITH 1/2" STAINLESS STEEL BOLTS.



CITY OF EUGENE  
EXHIBIT DRAWING

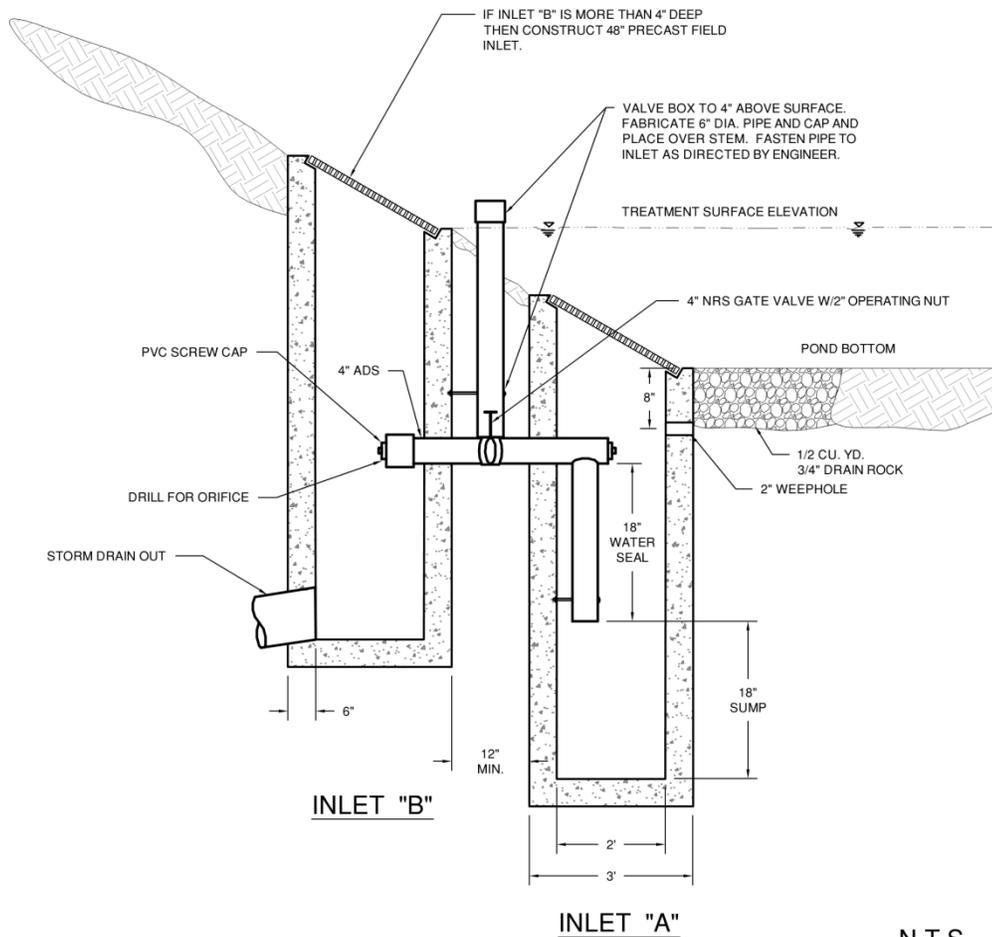


ORIFICE LOCATION BAFFLE RISER

REVISIONS	
DATE	DESCRIPTION

6/06

EXHIBIT 2-8



N.T.S.

CITY OF EUGENE  
EXHIBIT DRAWING



ORIFICE STRUCTURE

REVISIONS	
DATE	DESCRIPTION

6/06

EXHIBIT 2-9

## Rectangular Notched Sharp Crested Weir

$$Q = C(L - 0.2H) * H^{1.5}$$

Where:

Q=Weir discharge, cubic feet per second (cfs)

C = 3.27 + 0.40\*H/P, feet

P = Height of weir bottom above downstream water surface, feet

H = Height from weir bottom to crest, feet

L = Length of weir, feet\*

\* For weirs notched out of circular risers, length is the portion of the riser circumference not to exceed 50 percent of the circumference.

## V-Notched Sharp Crested Weir

$$Q = C_d \left( \tan \frac{\theta}{2} \right) H^{\frac{5}{2}}$$

Where:

Q = Weir discharge, cfs

C<sub>d</sub> = Contraction coefficient, feet (suggested value = 2.5 for 90 degree weir)

θ = Internal angle of notch, degrees

H = Height from weir bottom to crest, feet

**ROCK PROTECTION AT OUTFALLS FOR PIPES GREATER THAN 6 INCHES IN DIAMETER**

Discharge Velocity at Design Flow (fps)			REQUIRED PROTECTION Minimum Dimensions				
			Type	Depth*	Width	Length**	Height
0	To	5	Riprap*	2 x (max stone size)	Diameter + 6 ft.	As calculated	Crown + 1 ft.
6	To	10	Riprap*	2 x (max stone size)	Diameter + 6 ft. or 3x dia. whichever is greater	As calculated	Crown + 1 ft.
11	To	20	Gabion or Riprap*	2 x (max stone size)	Diameter + 6 ft. or 4x dia. whichever is greater	As calculated	Crown + 1 ft.
Over 20			Engineered Energy Dissipater Required				

\* Riprap size shall be determined using the following formulae\*\*\* and the City's *Standard Construction Specifications*

V = Average velocity (ft/s)      \*Riprap size  $ds=0.25*Do*Fo$  (6" minimum)

Do = Pipe diameter (ft)                      Depth= $2*ds$  (1 foot minimum)

ds = Riprap diameter (ft)              \*\*Apron length  $Lsp= Do(8+17*Log Fo)$

Lsp = Apron length (ft)

depth = Thickness (ft)

Fo =  $V/(g*Do)^{0.5}$

$g = 32.2 \text{ ft/s}^2$

\*\*\*US Army Corps of Engineers design formulas from *Erosion and Riprap Requirements at Culvert and Storm Outlets*, January 1970

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**APPENDIX G**

**INFILTRATION TESTING**

## APPENDIX G

### INFILTRATION TESTING

To properly size and locate stormwater management facilities, it is necessary to characterize the soil infiltration conditions at the location of the proposed facility. All projects that propose onsite infiltration must evaluate existing site conditions and determine:

1. If the infiltration rate is adequate to support the proposed stormwater management facility (satisfied through presence of mapped NRCS Type A & B Soils or the Simplified Approach infiltration test) or;
2. The design infiltration rate prior to facility design (satisfied through the Presumptive Approach infiltration testing conducted by a qualified professional).

The following sections provide the approved standard infiltration testing specifications.

#### **Simplified Approach Open Pit Infiltration Test**

The purpose of the Simplified Approach is to provide a method which can be conducted by a nonprofessional for design of simple stormwater systems on small projects. The Simplified Approach open pit test is applicable only to projects on private property with less than 15,000 square feet of new or redeveloped impervious area. The results of infiltration testing must be documented on the Simplified Approach Form.

The Simplified Approach cannot be used to find a design infiltration rate. The intent of the open pit test is to determine whether or not the local infiltration rate is adequate (2 inches/hour or greater) for the predesigned stormwater facilities described in Chapter 2 (infiltration swales, basins, planters, drywells, and trenches). The Simplified Approach Infiltration Test does not need to be conducted by a licensed professional.

#### **Simplified Approach Procedure**

A simple open pit infiltration test is required for each facility designed through the Simplified Approach. The test should be where the facility is proposed or within the immediate vicinity.

Excavate a test hole to the depth of the bottom of the infiltration system, or otherwise to 4 feet. The test hole can be excavated with small excavation equipment or by hand using a shovel, auger, or post hole digger. If a layer hard enough to prevent further excavation is encountered, or if noticeable moisture/water is encountered in the soil, stop and measure this depth from the surface and record it on the Simplified Approach Form. Proceed with the test at this depth.

Fill the hole with water to a height of about 6 inches from the bottom of the hole, and record the exact time. Check the water level at regular intervals (every 1 minute for fast-draining soils to every 10 minutes for slower-draining soils) for a minimum of 1 hour or until all of the water has infiltrated. Record the distance the water has dropped from the top edge of the hole.

Repeat this process two more times, for a total of three rounds of testing. These tests should be performed as close together as possible to accurately portray the soil's ability to infiltrate at different levels of saturation. The **third test** provides the best measure of the saturated infiltration rate.

For each test pit required, submit all three testing results with the date, duration, drop in water height, and conversion into inches per hour.

If the results of the Simplified Approach open pit test show an infiltration rate greater than 2.0 inches per hour, the applicant can proceed with Simplified Approach facility design (where applicable). If the applicant would like to use an infiltration rate for design purposes, a Presumptive Infiltration Test must be conducted.

### **Presumptive Infiltration Testing**

The Presumptive Approach must be used for all public and private developments where the Simplified Approach is not applicable. The qualified professional must exercise judgment in the selection of the infiltration test method. The three infiltration available testing methods used to determine a design infiltration rate are:

- Open pit falling head
- Encased falling head
- Double-ring infiltrometer

Where satisfactory data from adjacent areas is available that demonstrates infiltration testing is not necessary, the infiltration testing requirement may be waived. Waiver of the site specific testing is subject to approval by the City. Recommendation for foregoing infiltration testing must be submitted in a report which includes supporting data and is stamped and signed by the project engineer or geologist.

### **Testing Criteria**

Testing must be conducted or overseen by a qualified professional. This professional must be a Professional Engineer, Registered Geologist, Soil Scientist or other professional testing service with equivalent training and experience in determining the permeability of soils.

The depth of the test must correspond to the facility depth. If a confining layer is observed during the subsurface investigation to be within 4 feet of the bottom of the planned infiltration system, the testing should be conducted within that confining layer.

Tests must be performed in the immediate vicinity of the proposed facility. Exceptions can be made to the test location provided the qualified professional can support that the strata are consistent from the proposed facility to the test location.

Infiltration testing should not be conducted in engineered or undocumented fill.

### **Minimum Number of Required Tests**

The simplified Approach requires one infiltration test for every proposed facility. The Presumptive Approach requires one infiltration test for every proposed facility or one test for every 100 feet of proposed linear facility. Generalized soil infiltration rates may be used if facilities are proposed in areas of consistent topography and soil strata as outlined in a Geotechnical report.

### **Factor of Safety**

A minimum factor of safety of 2 shall be applied to field obtained infiltration rates where infiltration of the flood control design storm is proposed.

## **Presumptive Infiltration Testing Instructions**

### **Open Pit Falling Head Procedure**

The open pit falling head procedure is performed in an open excavation and therefore is a test of the combination of vertical and lateral infiltration.

1. Excavate a hole with bottom dimensions of approximately 2 feet by 2 feet into the native soil to the elevation of the proposed facility bottom. Smooth excavations should be scratched and loose material removed.
2. Fill the hole with clean water a minimum of 1 foot above the soil to be tested, and maintain this depth of water for at least 4 hours (or overnight if clay soils are present) to presoak the native material. In sandy soils with little or no clay or silt, soaking is not necessary. If after filling the hole twice with 12 inches of water, the water seeps completely away in less than 10 minutes, the test can proceed immediately.
3. Determine how the water level will be accurately measured. The measurements should be made with reference to a fixed point.
4. After the presaturation period, refill the hole with water to 12 inches above the soil and record the time. Alternative water head heights may be used for testing provided the presaturation height is adjusted accordingly. Measure the water level at 10-minute intervals for a total period of 1 hour (or 20-minute intervals for 2 hours in slower soils) or until all of the water has drained. In faster draining soils (sands and gravels), it may be necessary to shorten the measurement interval in order to obtain a well defined infiltration rate curve. Constant head tests may be substituted for falling head tests at the discretion of the professional overseeing the infiltration testing.
5. Repeat the test. Successive trials should be run until the percent change in measured infiltration rate between two successive trials is minimal. The trial should be discounted if the infiltration rate between successive trials increases. At least three trials must be conducted. After each trial, the water level is readjusted to the 12 inch level.
6. The average infiltration rate over the last trial should be used to calculate the unfactored infiltration rate. The final rate must be reported in inches per hour.
7. For very rapidly draining soils, it may not be possible to maintain a water head above the bottom of the test pit. A rate based test may be used if the infiltration rate meets or exceeds the flow of water into the test pit.

Note that a maximum infiltration rate of 20 inches per hour can be used in stormwater system design.

### **Encased Falling Head Test**

The encased falling head procedure is performed with a 6-inch casing that is embedded approximately 6 inches into the native soil. The goal of this field test is to evaluate the vertical infiltration rate through a 6-inch plug of soil, without allowing any lateral

infiltration. The test is not appropriate in gravelly soils or in other soils where a good seal with the casing cannot be established.

Embed a solid 6-inch diameter casing into the native soil at the elevation of the proposed facility bottom. Ensure that the embedment provides a good seal around the pipe casing so that percolation will be limited to the 6-inch plug of the material within the casing. This method can also be used when testing within hollow stem augers, provided the driller and tester are reasonably certain that a good seal has been achieved between the soil and auger.

Fill the pipe with clean water a minimum of 1 foot above the soil to be tested, and maintain this depth for at least 4 hours (or overnight if clay soils are present) to presoak the native material. Any soil that sloughed into the hole during the soaking period should be removed. In sandy soils with little or no clay or silt, soaking is not necessary. If after filling the hole twice with 12 inches of water, the water seeps completely away in less than 10 minutes, the test can proceed immediately.

To conduct the first trial of the test, fill the pipe to approximately 12 inches above the soil and measure the water level. Alternative water head heights may be used for testing provided the presaturation height is adjusted accordingly. The level should be measured with reference to a fixed point. Record the exact time.

Measure the water level at 10-minute intervals for a total period of 1 hour (or 20-minute intervals for 2 hours in slower soils) or until all of the water has drained. In faster draining soils (sands and gravels), it may be necessary to shorten the measurement interval in order to obtain a well defined infiltration rate curve. Constant head tests may be substituted for falling head tests at the discretion of the professional overseeing the infiltration testing. Successive trials should be run until the percent change in measured infiltration rate between two successive trials is minimal. The trial should be discounted if the infiltration rate between successive trials increases. At least three trials must be conducted. After each trial, the water level is readjusted to the 12 inch level.

The average infiltration rate over the last trial should be used to calculate the unfactored infiltration rate. Alternatively, the infiltration rate measured over the range of water head applicable to the project stormwater system design may be used at the discretion of the professional overseeing the testing. The final rate must be reported in inches per hour.

### **Double Ring Infiltrometer Test**

The double-ring infiltrometer test procedure should be performed in accordance with ASTM 3385-94. The test is performed within two concentric casings embedded and sealed to the native soils. The outer ring maintains a volume of water to diminish the potential of lateral infiltration through the center casing. The volume of water added to the center ring to maintain a static water level is used to calculate the infiltration rate. The double-ring infiltrometer is appropriate only in soils where an adequate seal can be established.

## **Reporting Requirements**

The following information should be included in the Infiltration Testing Report. The Infiltration Testing Report should be attached to the project's Stormwater Management Report:

1. Statement of project understanding (proposed stormwater system).
2. Summary of subsurface conditions encountered.
3. Summary of infiltration testing including location and number of tests and testing method used. Discussion of how the tests were performed (i.e. pipe type or diameter or test pit dimensions).
4. Infiltration testing results in inches per hour.
5. Recommended design infiltration rate including factors of safety.
6. Groundwater observations within exploration and an estimate of the depth to seasonal high groundwater.
7. Site plan showing location of infiltration tests.
8. Boring or test pit logs. The logs should include an associated soil classification consistent with ASTM D2488-00, Standard Practice for Classification for Description and Identification of Soils (Visual-Manual Procedure). The logs should also include any additional pertinent subsurface information, such as soil moisture conditions, depth and description of undocumented or engineered fill, soil color and mottling conditions, soil stiffness or density, and approximate depth of contact between soil types.
9. Infiltration Test Data

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**APPENDIX H**

**STORMWATER ANALYSES REPORTS**

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## APPENDIX H

### STORMWATER ANALYSIS REPORT REQUIREMENTS

A Stormwater Management Report is required for every site improvement where the Presumptive Approach is used. The report shall be prepared by a licensed Civil Engineer in the State of Oregon. The report should include the following information where applicable:

#### Cover Sheet

- Project name and owner
- Site address
- Associated permit numbers
- Engineer
- Firm
- Address
- Contact information
- Oregon Professional Engineer's registration stamp

#### Table of Contents

##### Project Overview and Description

- Size and location of project site (vicinity map)
- Type of development/proposed improvements
- Watershed description
- Permits required (local, state, federal)
- Existing vs. post-construction conditions

##### Methodology

- Drainage at existing site
- Potential impacts on the proposed site from existing conditions
- Potential impacts from the proposed site on existing drainage
- Techniques for mitigating potential conflicts or problems
- Infiltration testing results
- Narrative that defines the proposed stormwater management techniques, including discharge point(s) for runoff from private and public impervious areas
- Stormwater hierarchy category justification

## **Analysis**

- Design Assumptions
- Design storms used
- Computation methods
- Software used
- Safety factors, curve numbers, and design coefficients
- Clarify variations from the norm
- PAC narrative form and printouts
- Conveyance requirements and design
- Table of impervious area treated (differentiates public vs. private and roof vs. pavement).
- Comparison table of the flow rates for pre and post construction. Table must show that the project meets the flow control requirements if applicable
- Determination of the flood control point of discharge and capacity of receiving system

## **Engineering Conclusions**

- Based on compliance with Stormwater Management Manual
- How water quality, flow control, and flood control requirements are satisfied
- Stormwater Facility Details/Exhibits
- Contour maps of pre and post development
- Impervious area identification
- Watershed delineation
- Existing and new drainageways
- Point(s) of discharge
- Delineation of each catchment

## **Additional Forms**

- Source Control Special Circumstances Installations (if applicable)
- Special Circumstances (if applicable)
- Other Reports (is applicable)

## **APPENDIX I**

### **INFILTRATION LIMITED AREAS MAP AND NRCS SOIL GROUP MAP**

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# Infiltration Limited Areas

## LEGEND

-  Eugene Urban Growth Boundary
-  Storm Water Basins
-  Rivers and Streams

### Infiltration Limiting Criteria

-  Depth to Bedrock less than 5 feet\*
-  Permeability less than 0.6 inches/hour\*
-  Depth to Groundwater less than 6 feet\*
-  Slopes greater than 15 percent

This map displays areas that are not likely to meet the City's proposed subsurface infiltration design requirements. Detailed site-specific information will be required for all proposed infiltration facilities whether required by the City or initiated by the property owner.

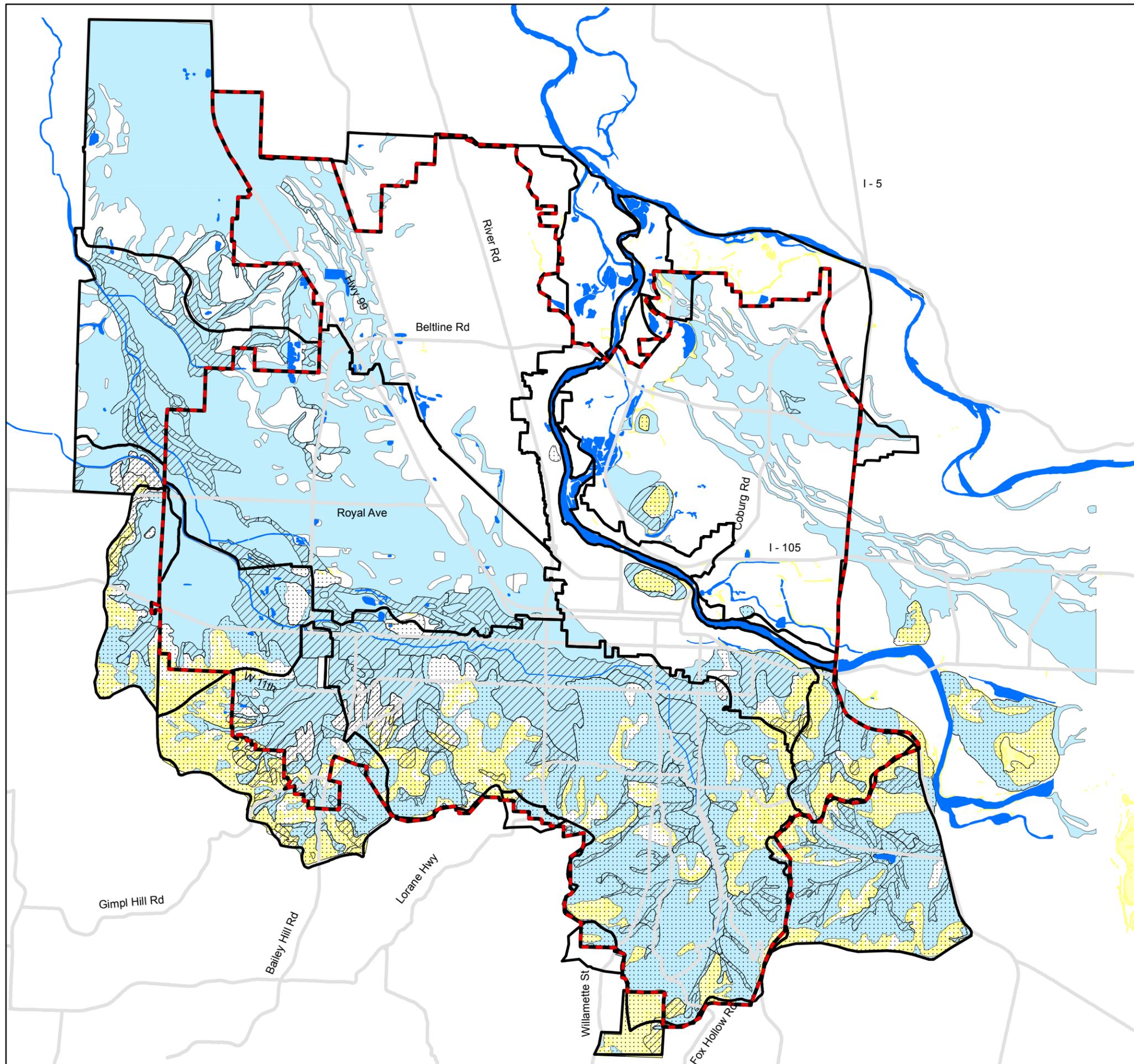
\* from USDA Natural Resources Conservation Services

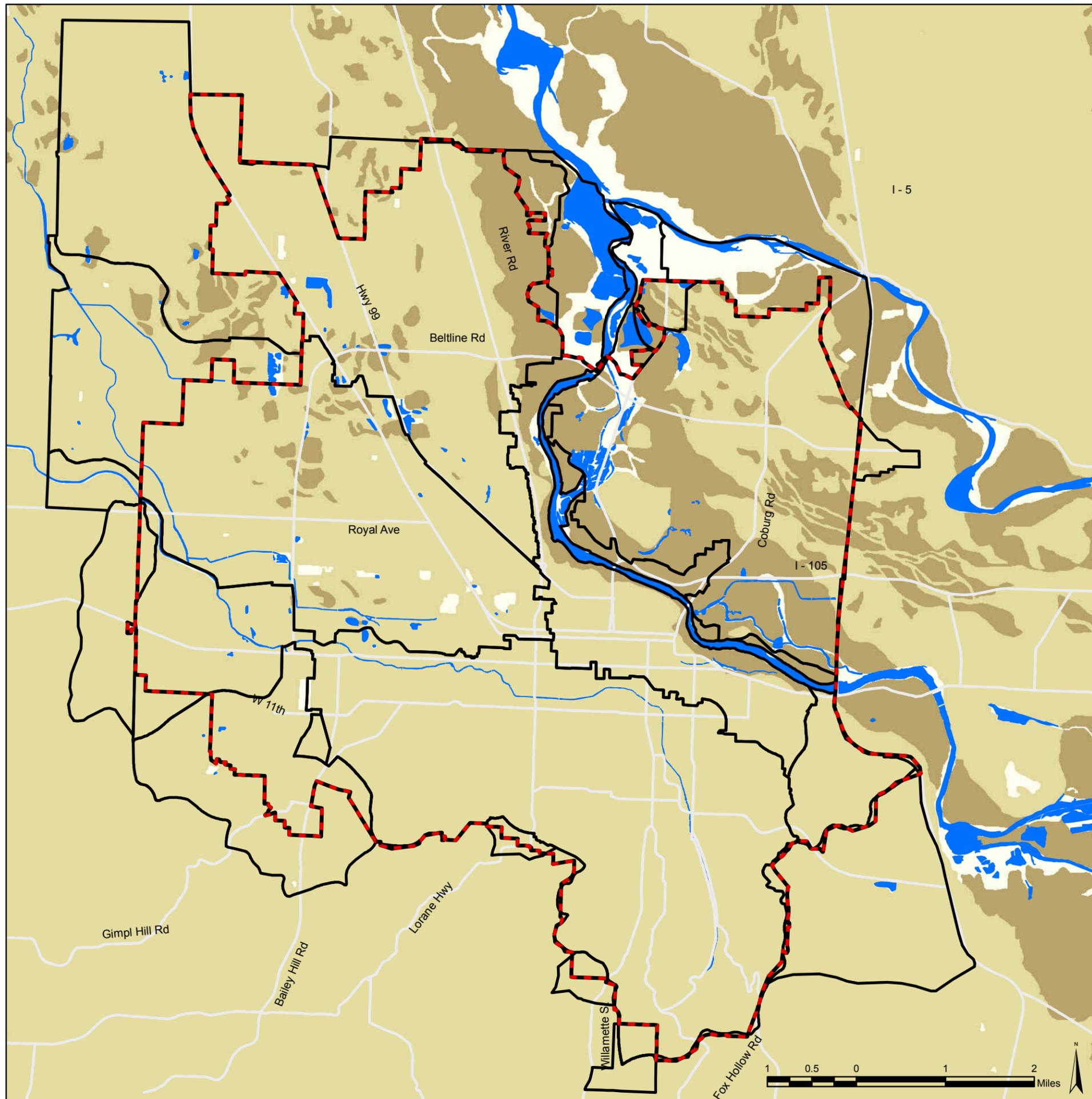
Figure 1. Infiltration limited areas in Eugene



Map produced by City of Eugene PW Eng Info Team, May 25 2006 (ref# 0605-1467)

Map based on imprecise source data, subject to change





# Hydrologic Soil Groups

## LEGEND

-  Eugene Urban Growth Boundary
-  Storm Water Basins
-  Rivers and Streams

### Hydrologig Group

-  A and B
-  C and D

Map based on imprecise source data, subject to change

**APPENDIX J**

**HEADWATERS STREAM MAP**

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# Headwaters Streams Map

## LEGEND

-  Headwater Stream\*
-  Eugene Urban Growth Boundary
-  City Limits
-  500 ft Elevation Line
-  Rivers and Streams

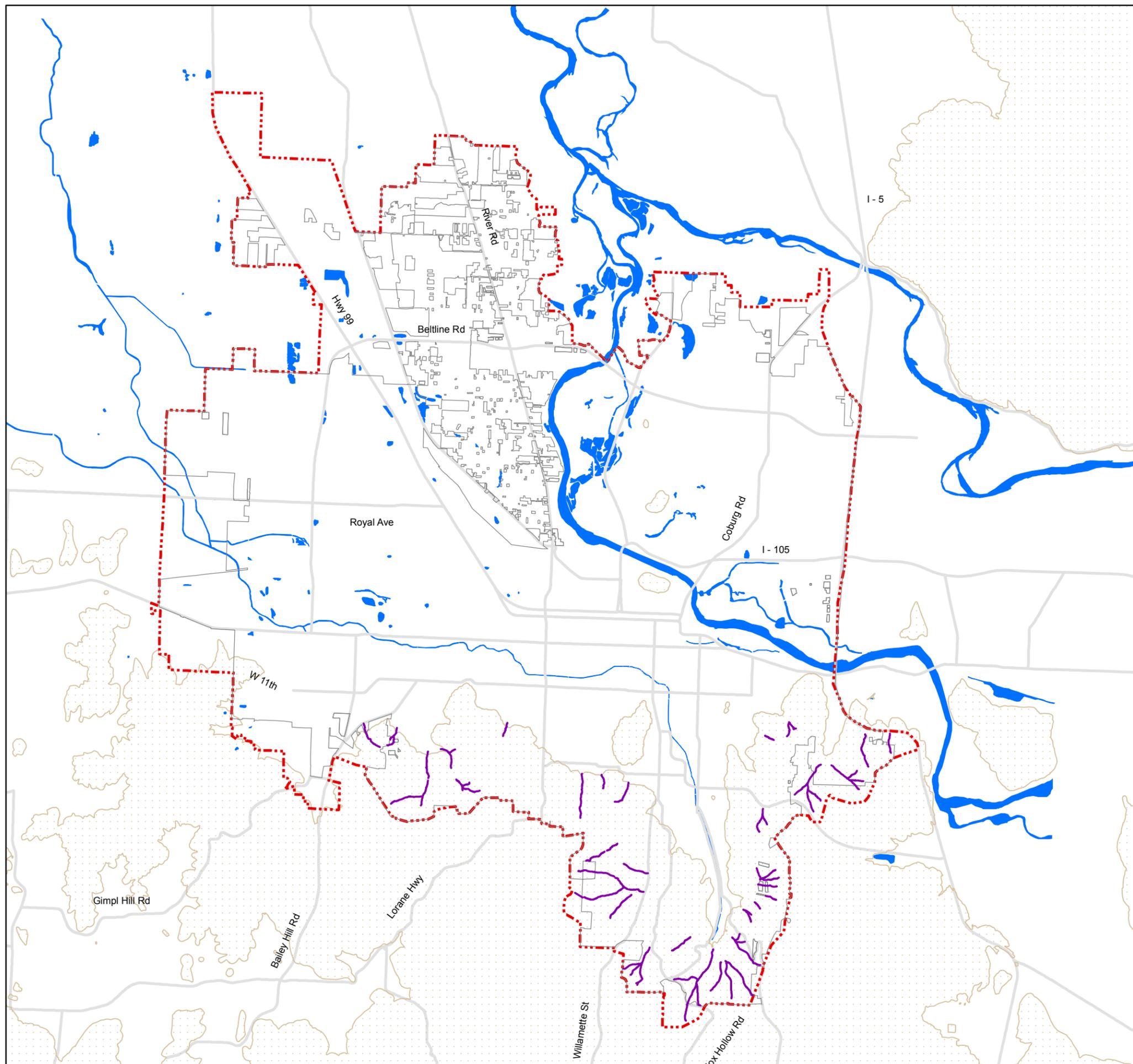
### Definition:

\* Headwater Streams: a waterbody having a minimum length of 500 feet and provides a drainage area of 10 acres or more, and is identified on the City of Eugene's Sensitive Areas Map having all or a portion of its length greater than 10% slope and affected by highly erodible soils



Map produced by City of Eugene PW Eng Info Team, June 02 2006 (ref# 0605-1467)

Map based on imprecise source data, subject to change



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**APPENDIX K**

**FLOOD CONTROL DESIGN STORM TABLES**

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## SECTION 3 Study Methods for Identifying Problems and Opportunities

**Table 3-1  
Storm Recurrence Intervals for Planning and Design of Drainage Improvements**

Drainage Area (acres)			Type of Drainage Improvement				Design Storm Recurrence Interval in Years
			Open Channel	Closed Pipe	Culverts and Bridges - Type of Roadway		
<40	40 TO 640	>640	(a)	(b)	Major Collectors and Neighborhood Collectors (c)	Major Arterials and Minor Arterials (d)	(e)
X				X			5/10 (h)
X			X		X	X	10 (f)
	X			X			10 (f)
	X		X		X		10 (f)
	X					X	25
		X	X	X(g)	X		25
		X				X	50
All improvements on waterways with FEMA 100-year floodplains							100

- (a) Includes roadside ditches and drainage swales
- (b) Storm sewer systems or a closed conduit whose length exceeds that of a normal culverted crossing of a single roadway
- (c) Includes local or residential streets, local collectors, and any other roadways up to a major arterial
- (d) Major arterial or better within the City's right-of-way maintenance
- (e) Assuming ultimately planned development conditions (i.e., impervious cover) within the City's Urban Growth Boundary (UGB) and existing development conditions outside of the City's UGB
- (f) The 5-year recurrence interval can be used in unusual situations involving sufficient topographical conditions that result in an exceptionally high cost differential between the 10-year and 5-year improvement design (e.g., 40%)
- (g) Closed pipe systems should not be used on waterways draining more than 640 acres (i.e., 1 square mile)
- (h) The 5-year storm may be used when the Rational Method is applied to calculate the design flow rate. The 10-year storm should be used for closed pipes with <40 acre drainage areas when using the City's SWMM modeling results or when extending the City's SWMM model using consistent methods and assumptions as used for the City's SWMM modeling work.

## SECTION 3 Study Methods for Identifying Problems and Opportunities

**Table 3-2  
Selected Design Events for Each Basin**

Design Event	Amazon Creek	Willow Creek	Bethel Danebo	Laurel Hill	Willakenzie	Willamette River
10-Year	11/25/77	11/23/60	11/23/60	11/25/77	11/25/77	8/16/68 2/5/96
25-Year Summer	8/16/68	**	8/16/68	8/16/72	8/21/79	*
25-Year Winter	2/5/96	2/5/96	10/31/94	10/31/94	10/31/94	*
50-Year	5.76" SCS Type 1A	*				
100-Year	6.48" SCS Type 1A	*				

\*For the Willamette basin, only the 10-year storm was needed for the evaluation because only selected portions of the basin were modeled.

\*\*For the Willow Creek basin, an August storm was not evaluated as the short, high-intensity events were not as critical in this basin as the long duration, high-volume events.

**Table 3-3  
Design Events Characteristics**

Design Event	Rainfall Volume (inches)	Maximum Intensity (in/hour)	Approximate Duration (hours)
11/23/60	7.36	0.67	114
8/16/68	1.36	1.14	10
8/16/72	1.38	0.92	5
11/25/77	2.09	0.66	7
8/21/79	1.82	1.11	3
10/31/94	4.05	0.70	32
2/5/96	7.24	0.66	51
50-Year SCS Type 1A	5.76	0.95	24
100-Year SCS Type 1A	6.48	1.06	24

The above information is based on NWS rain gage data.

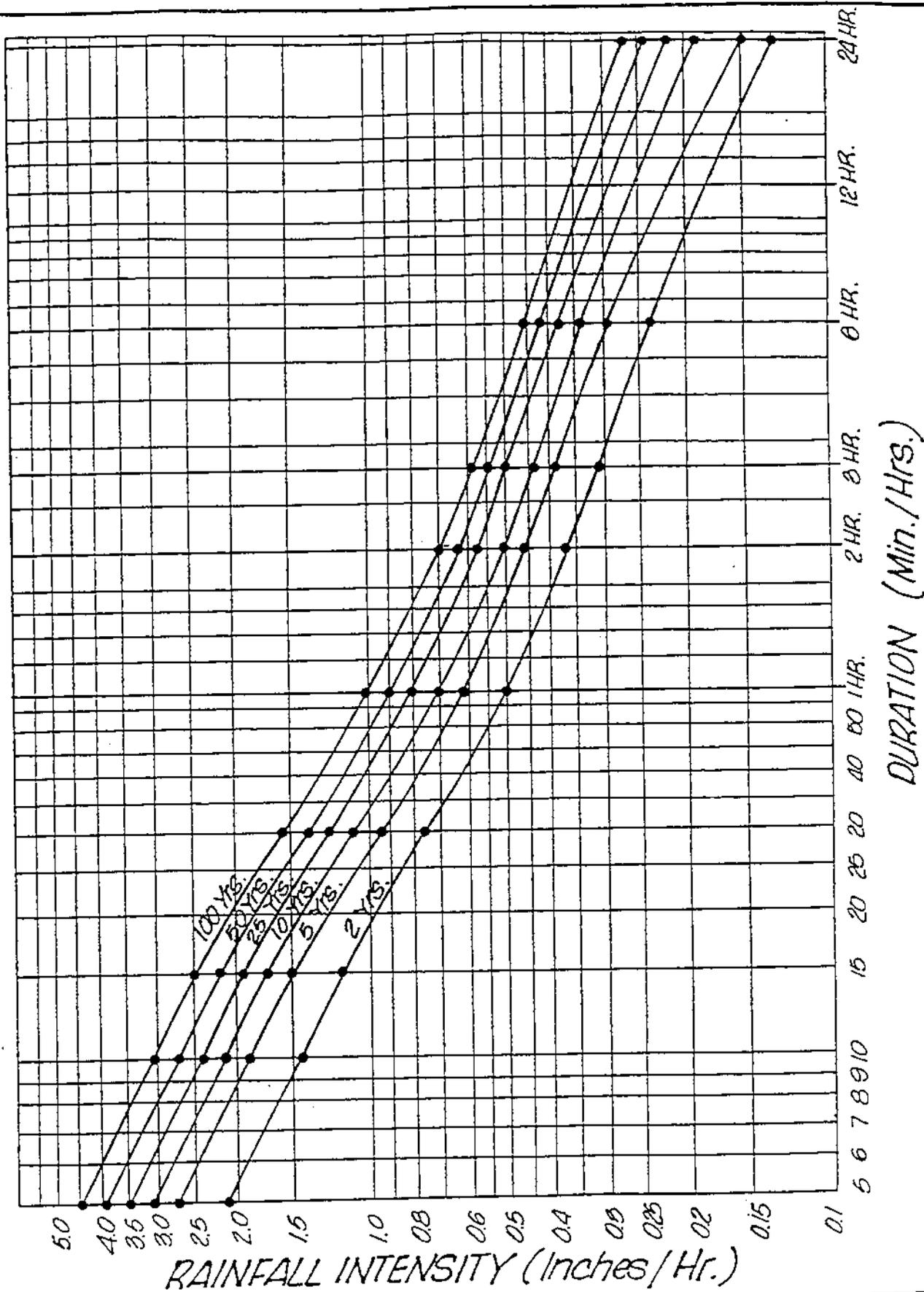


FIGURE 4.1  
 Rainfall Intensity, Duration and  
 Frequency Curves for Eugene, Oregon

**otak** INC.  
 ARCHITECTS, P.C.  
 incorporated

17355 SW Boones Ferry Rd. Lake Oswego OR 97035 (503) 635-2618  
 101 E 8th Street, Vancouver WA 98660 (206) 695-0257  
 11058 Main Street #215, Bellevue WA 98004 (206) 455-5342

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## **APPENDIX L**

### **WATER QUALITY DESIGN STORM DEVELOPMENT**

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## APPENDIX L

### CITY OF EUGENE DEVELOPMENT STANDARDS MEMORANDUM #4 WATER QUALITY DESIGN STORM SELECTION

#### INTRODUCTION

In Development Standards Memorandum #2, the following four approaches for implementing stormwater quality requirements were considered:

1. Stormwater quality facilities are required to reduce pollutants in the stormwater runoff resulting from a specified amount of rainfall, or "water quality design storm"
2. Stormwater quality facilities are required to meet a specified performance threshold (e.g., 80% removal of TSS)
3. Specific stormwater quality facilities are required for specific land uses
4. In-lieu-of fees are allowed

Based on the advantages and disadvantages described for each of the four approaches, we decided to further evaluate Approach #1 – Stormwater quality facilities are required to reduce pollutants in the stormwater runoff resulting from a specified water quality design storm.

Structural stormwater quality facilities (i.e., not site planning) can generally be divided into two groups based on different design requirements: detention facilities and flow-through facilities. Detention type facilities include dry ponds, wet ponds, and stormwater marshes. These facilities are designed to allow for the settling of particulates and other pollutants in stormwater by storing the stormwater runoff for a certain period. Therefore, the total rainfall (depth in inches) of the water quality design storm needs to be specified to determine the appropriate size of a detention type facility.

Flow-through facilities include vegetated swales and/or structural facilities with filter media such as sand or compost. These facilities remove particulates and other pollutants by mechanical means (e.g., baffles) or by passing the stormwater through a filtration media (e.g., vegetation, sand or compost). Since flow-through type facilities operate with little or no detention, these types of facilities are designed to treat a maximum flow rate rather than a total runoff volume. Therefore, the rainfall intensity (inches/hour) of the water quality design storm needs to be specified to determine the appropriate size of a flow-through based facility.

The purpose of this memorandum is to describe the methods used to select the water quality design storm parameters for detention type and flow-through type stormwater quality facilities. This memo contains the following information:

- Description of measured rainfall data sources

- Description of the rainfall analysis procedures
- A discussion of the conceptual design procedure for the preliminary capital projects
- Summary of the results of the water quality design storm analysis
- Comparison to other jurisdictions
- Recommendation for further evaluation

## **LONG-TERM RAINFALL DATA SOURCES**

The parameters of the water quality design storm (i.e., total rainfall and rainfall intensity) are based on a statistical analysis of local long-term rainfall data. Hourly rainfall measurements are needed to determine the total rainfall volume for designing detention type facilities. For Eugene, long-term hourly precipitation data are available from a rain gage operated by the National Weather Service (NWS) at the Eugene Airport. Hourly precipitation data is available for this gauge location from 1948 to the present.

Shorter increment rainfall measurements (i.e., 5 to 15 minutes) are more appropriate for determining the rainfall intensity for designing flow-through type facilities. The City has operated several rain gauges within Eugene for the past six years that measure rainfall at 15-minute increments. The rainfall data collected at City gauge 11 (located in west Eugene on the Bertlesen Slough) and City gauge M2 (located in Amazon Park) were used in this analysis.

## **RAINFALL ANALYSIS PROCEDURES**

The statistical analyses of the long-term hourly rainfall measurements collected by the NWS at the Eugene Airport were completed using the Synoptic Rainfall Data Analysis Program (SYNOP). SYNOP provides a summary and statistical analysis of storm event parameters (e.g., rainfall depths, storm intensity, storm duration) and of annual and monthly rainfall totals. The two key input variables in SYNOP are the inter-event time and minimum storm depth. The inter-event time represents the minimum length of dry period, in hours, beyond which additional rainfall measurements are considered to be separate storm events. It is used to separate a long-term continuous rainfall record into discrete, independent storm events. The minimum storm depth is applied to eliminate small storm events from the long-term record that are unlikely to produce measurable stormwater runoff. Storm events with a depth of 0.01 inches or less were eliminated from the long-term record as they are unlikely to produce measurable stormwater runoff. Additional analyses of the results from SYNOP were completed using Microsoft Excel.

## **CONCEPTUAL DESIGN OF PRELIMINARY CAPITAL PROJECTS**

In order to develop conceptual designs for the preliminary capital projects identified during the basin planning process, a preliminary water quality design storm was needed. A SYNOP analysis was completed on the long-term hourly precipitation data from the NWS gage at the Eugene airport using an inter-event time of 6 hours and a minimum storm depth of 0.01 inches. The results of the SYNOP and spreadsheet

analyses are presented in Figure 1.

The plot in Figure 1 presents the average annual percentage of storm events (y axis) that are equal to or less than a specific design storm rainfall depth (x axis). For example, approximately 80% of the storm events have a rainfall depth of 1.4 inches or less. Therefore, if a detention type stormwater quality facility were designed to capture and treat the stormwater runoff from a site resulting from a 1.4 inch storm event, approximately 80% of the annual stormwater runoff from the site would be treated. This storm depth, 1.4 inches, was selected as the preliminary water quality design storm for completing the conceptual designs for the detention type stormwater quality capital projects.

## **WATER QUALITY DESIGN STORM ANALYSIS**

Based on recent Department Advisory Committee meetings, it seems apparent that development standards for stormwater quality are recommended for portions of Eugene. Therefore, we completed a more detailed analysis of the NWS and City rainfall records to develop the specific parameters of the water quality design storm for implementing development standards. The total rainfall and rainfall distribution is required to design detention type stormwater quality facilities. The rainfall intensity is required to design flow-through type facilities (both off-line and on-line). The procedures used to obtain these water quality design storm parameters are described below.

### **Detention Type Water Quality Facilities**

Long-term hourly precipitation data at the Eugene airport were analyzed to select the water quality design storm parameters for designing detention type stormwater quality facilities. The SYNOP analysis was conducted using an inter-event time of 6 hours and a minimum storm depth of 0.01 inches. Based on the results presented in Figure 1, a design storm rainfall depth of 1.4 inches is required to capture approximately 80% of the average annual runoff from a site. A design storm rainfall depth of 0.95 inches is required to capture approximately 70% of the average annual runoff from a site. A design storm rainfall depth of 2.4 inches is required to capture 90% of the average annual runoff from a site.

The rainfall distribution describes the temporal distribution for the total rainfall. The U.S. Soil Conservation Service (SCS) developed a rainfall distribution for western Oregon and Washington referred to as SCS Type 1A. The duration of the SCS Type 1A storm event is typically specified as 24 hours. Based on our SYNOP analysis, the average storm durations for a 6-hr, 12-hr, and 24-hr inter-event time were 16 hours, 26 hours, and 46 hours, respectively. Therefore, a 24-hour rainfall distribution appears to be appropriate.

### **Flow-through Type Water Quality Facilities**

Flow-through type facilities can be installed as off-line or on-line structures. With off-line facilities, an inlet control structure (e.g., flow control manhole) is installed to limit

the maximum allowable flow rate that can be treated by the stormwater quality facility. Stormwater flows that exceed the maximum allowable flow rate are bypassed around the facility. The off-line configuration minimizes the possibility that particulates and other pollutants previously trapped by the facility will be resuspended and transported downstream during higher flows.

For on-line facilities, the high flows are not bypassed around the stormwater quality facility. A typical example of this type of facility is a vegetated swale. Most vegetated swales are designed to treat the peak flow rate resulting from the water quality design storm but also convey the peak flow rate resulting from the flood control design storm. During high flows, the treatment effectiveness of an on-line facility is eliminated or greatly reduced. Furthermore, there is a risk that a portion of the particulates and other pollutants that were previously trapped by the on-line facility could be resuspended and transported downstream. Due to these concerns, for an equivalent drainage area, an on-line facility typically must be significantly larger than an off-line facility to provide an equivalent degree of water quality treatment. Therefore, two rainfall intensities need to be specified for designing these facilities: one for the design of on-line facilities and one for the design of off-line facilities.

#### QA/QC for the 15-Minute Rainfall Data Collected at City Gauges 11 and M2

The 15-minute rainfall data collected at City gauges 11 and M2 were used to determine the rainfall intensity for designing flow-through type facilities. The rainfall data were available from 11 and M2 from January 1995 to December 1999. A comparison of the rainfall data from the two gauges indicated that significant differences exist in the two data sets for some periods of record. Therefore, the 15-minute rainfall data collected at 11 and M2 were studied and analyzed for quality assurance and control purposes. The daily precipitation data collected from the NWS Rain Gauge at the Eugene Airport were also used in the data QA/QC process. The steps involved in data QA/QC are summarized below.

First we calculated daily precipitation at 11 and M2 from 1995 to 1999 by summing all the 15-minute rainfall data collected on each individual day. The daily precipitation at 11 and M2 were then compared with the daily precipitation data collected from the National Weather Service Rain Gauge at the Eugene Airport. One rainfall data file was developed from the two city data sets (i.e., the 11 and M2 rain gages) based on the following criteria:

- If the daily precipitation data for specific dates at one city gauge were significantly different from the daily rainfall data from the NWS gauge and the other city gauge, the data collected at this city gauge were excluded for those dates;
- If the daily precipitation data collected at the two city gauges were similar for a storm event but were quite different from the data collected from NWS, the city gauge that had the closer daily rainfall values to the NWS data were included in the combined data set;

- For certain days in a month that the daily rainfall data were different at all three rain gauges, data from the city gauge that was excluded the least frequently in that month was included in the combined data set.

The following periods of precipitation data were excluded altogether from the records due to the malfunctioning of both the I1 and M2 rain gauges:

1. March 6, 1995 through March 31, 1995
2. September 1, 1999 through December 31, 1999.

The QA/QC results can be found in the spreadsheet files titled 1995.xls, 1996.xls, 1997.xls, 1998.xls and 1999.xls. The shaded areas in the spreadsheet represent the periods of record that were excluded. A new set of 15-minute rainfall data was developed by combining the 15-minute rainfall data collected at I1 and M2 from 1995 to 1999 as described above. A spreadsheet analysis was then performed on the combined data set to develop a frequency distribution of rainfall intensities for on-line and off-line flow-through water quality facilities. Descriptions of the spreadsheet analysis for both off-line and on-line flow-through facilities are provided in the following sections.

#### Off-line Flow-through Type Facilities

A spreadsheet analysis of the combined 15-minute rainfall data collected at City gauges I1 and M2 was completed to summarize the occurrence of rainfall intensities for off-line facilities. The results are presented in Figure 2. The results are based on the assumption that all stormwater runoff would be treated if the measured rainfall intensity was equal to or less than the design storm intensity. If the measured rainfall intensity exceeded the design storm intensity, then the percentage of the storm that could be treated was set equal to the ratio of the design storm intensity to the actual storm intensity. For example, if the facility is designed to treat storm events with a maximum intensity of 0.2 in/hr, then all the runoff from storm events with intensities less than or equal to 0.2 in/hr can be treated. However, if the rainfall intensity is 0.3 in/hr, then only 2/3 (or 66%) of the runoff generated this storm event would get treated.

Based on these assumptions, 80% of the average annual runoff volume would be treated if the off-line facility is designed using a rainfall intensity of 0.13 in/hr. Approximately 70% of the average annual runoff volume would be treated using a rainfall intensity of 0.08 in/hr, and 90% would be treated using a rainfall intensity of 0.19 in/hr.

#### On-line Flow-through Type Facilities

A spreadsheet analysis of the combined 15-minute rainfall data collected at City gauges I1 and M2 was also completed to summarize the occurrence of rainfall intensities for on-line facilities. The results are presented in Figure 2. The results for on-line facilities are based on a different set of assumptions than for off-line facilities. Similar to off-line facilities, if the measured rainfall intensity was less than or equal to the design storm

intensity, then all of the stormwater runoff would be treated. However, if the measured rainfall intensity exceeded the design storm intensity, the results are based on the assumption that all of the stormwater runoff from that event would not receive treatment.

Based on these assumptions, 80% of the average annual runoff volume would be treated if the off-line facility is designed using a rainfall intensity of 0.22 in/hr. Approximately 70% of the average annual runoff volume would be treated using a rainfall intensity of 0.17 in/hr, and 90% would be treated using a rainfall intensity of 0.34 in/hr.

## COMPARISON WITH OTHER JURISDICTIONS

Several other regional jurisdictions have recently adopted development standards for water quality. The following table presents the water quality requirements for Portland, Gresham, and the Unified Sewerage Agency with proposed requirements in Eugene.

Jurisdiction	Average Annual Rainfall (in)	Water Quality Design Storm			
		Detention Type Facilities		Flow-through Facilities	
		Total Rainfall (in)	Storm Duration	Off-line Facilities	On-Line Facilities
Portland	34	0.83	24-hr duration	Not Specified	Not Specified
Gresham	34	1.2	12-hr duration	0.11 in/hr	0.20 in/hr
USA	40	0.36	4-hr duration	Not Specified	Not Specified
Eugene	45	1.4	24-hr duration	0.13 in/hr	0.22 in/hr

## RECOMMENDATION

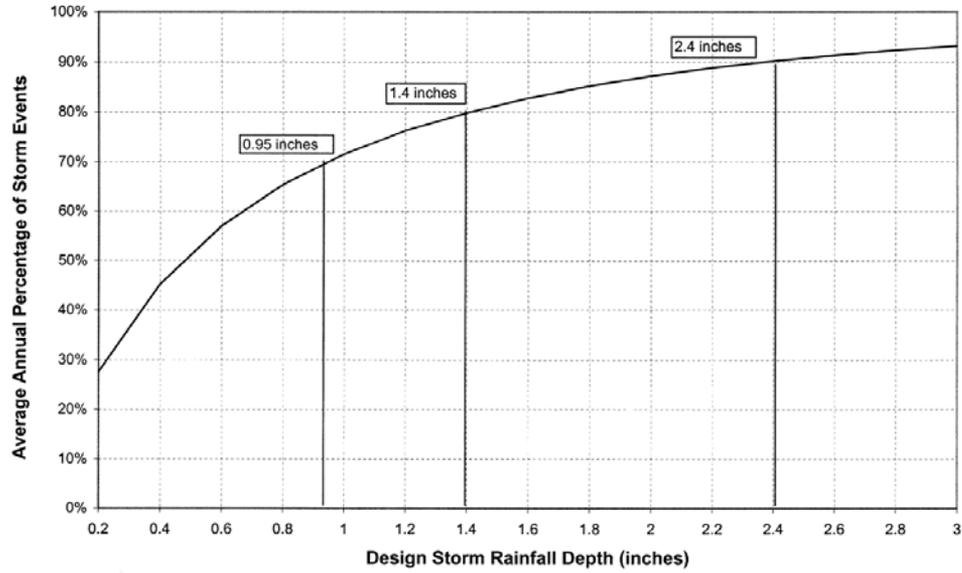
Based on the above analysis, we recommend that preliminary capital project designs and example site designs (for the DAC) incorporate the use of the following design storm specifications:

- For detention type facilities: required storage volume is equal to the stormwater runoff resulting from a 1.4 inch, 24-hour duration design storm
- For off-line flow-through type facilities: treat the peak flow rate resulting from a design storm with a rainfall intensity of 0.13 in/hr
- For on-line flow-through type facilities: treat the peak flow rate resulting from a design storm with a rainfall intensity of 0.22 in/hr

For the development of design tools (Task 400B1) and development of the BMP manual (Task 400B3), we recommend further analysis of the proposed design storms. Specifically, we recommend designing some example facilities to meet these requirements and running the **long-term** rainfall record through the facilities to ensure 80% capture of runoff.

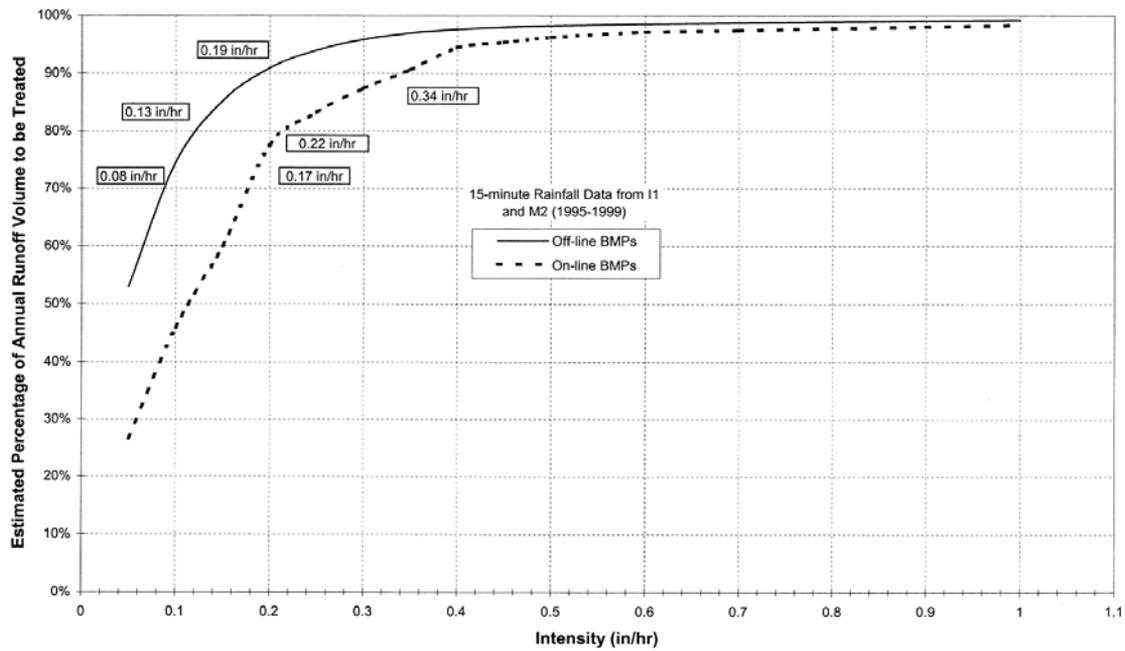
**Figure 1**

Occurrence of Storm Events Based on an Analysis of the 50-year NWS Rainfall Record from the Eugene Airport (inter-event time = 6 hrs, minimum storm volume = 0.01 in)



**Figure 2**

Eugene Stormwater Program  
Potential Water Quality Design Storms for Flow-Through Type Facilities



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## **APPENDIX M**

### **SANTA BARBARA UNIT HYDROGRAPH METHOD**

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## APPENDIX M

### SANTA BARBARA URBAN HYDROGRAPH METHOD

#### **Introduction**

The Santa Barbara Urban Hydrograph (SBUH) method was developed by the Santa Barbara County Flood Control and Water Conservation District to determine a runoff hydrograph for an urbanized area. It is a simpler method than some other approaches, as it computes a hydrograph directly without going through intermediate steps (i.e., a unit hydrograph) to determine the runoff hydrograph.

The SBUH method is a popular method for calculating runoff, since it can be done with a spreadsheet or by hand relatively easily. The SBUH method is the method approved by the City of Eugene for determining runoff when doing flow control calculations.

#### **Elements Of The SBUH Method**

The SBUH method depends on several variables:

- Pervious ( $A_p$ ) and impervious ( $A_{imp}$ ) land areas
- Time of concentration ( $T_c$ ) calculations
- Runoff curve numbers (CN) applicable to the site
- Design storm

These elements shall all be presented as part of the submittal process for review by staff. In addition, maps showing the pre-development and post-development conditions shall be presented to help in the review.

#### **Land Area**

The total area, including the pervious and impervious areas within a drainage basin, shall be quantified in order to evaluate critical contributing areas and the resulting site runoff. Each area within a basin shall be analyzed separately and their hydrographs combined to determine the total basin hydrograph. Areas shall be selected to represent homogenous land use/development units.

#### **Time of Concentration**

Time of concentration,  $T_c$ , is the time for a theoretical drop of water to travel from the furthest point in the drainage basin to the facility being designed. (In this case,  $T_c$  is derived by calculating the overland flow time of concentration and the channelized flow time of concentration.)  $T_c$  depends on several factors, including ground slope, ground roughness, and distance of flow. The following formula for determining  $T_c$  is:

### **Formulas**

$$T_c = T_{t1} + T_{c2} + T_{c3} + \dots + T_{cn}$$

$$T_t = L/60V \quad (\text{Conversion of velocity to travel time})$$

$$T_t = \frac{0.42 (nL)^{0.8}}{1.58(s)^{0.4}} \quad (\text{Manning's kinematic solution for sheet flow less than 300 feet})$$

Shallow concentrated flow for slopes less than 0.005 ft/ft.:

$$V = 16.1345(s)^{0.5} \quad (\text{Unpaved surfaces})$$

$$V = 20.3282(s)^{0.5} \quad (\text{Paved surfaces})$$

Where,

$T_t$  = travel time, minutes

$T_c$  = total time of concentration, minutes (minimum  $T_c$  = 5 minutes)

$L$  = flow length, feet

$V$  = average velocity of flow, feet per second

$n$  = Manning's roughness coefficient for various surfaces

$s$  = slope of the hydraulic grade line (land or watercourse slope), feet per foot

When calculating  $T_c$ , the following limitations apply:

- Overland sheet flow (flow across flat areas that does not form into channels or rivulets) shall not extend for more than 300 feet.
- For flow paths through closed conveyance facilities such as pipes and culverts, standard hydraulic formulas shall be used for establishing velocity and travel time.
- Flow paths through lakes or wetlands may be assumed to be zero (i.e.  $T_c = 0$ ).

### **Runoff Curve Numbers**

Runoff curve numbers were developed by the Natural Resources Conservation Service (NRCS) after studying the runoff characteristics of various types of land. Curve numbers (CN) were developed to reduce diverse characteristics such as soil type, land usage, and vegetation into a single variable for doing runoff calculations. The runoff curve numbers approved for water quantity/quality calculations are included as Table C-2 of this appendix.

The curve numbers presented in Table C-2 are for *wet* antecedent moisture conditions. Wet conditions assume previous rainstorms have reduced the capacity of soil to absorb water. Given the frequency of rainstorms in this area, wet conditions are most likely, and give conservative hydrographic values.

### Design Storm

The SBUH method also requires a design storm to perform the runoff calculations. For flow control calculations, use NRCS Type 1A 24-hour storm distribution. This storm is shown in Figure C-1 and Table C-4. The depth of rainfall for the 2 through 100-year storm events is shown below in Table C-1.

<u>Recurrence Interval, Years</u>	<u>2</u>	<u>5</u>	<u>10</u>	<u>25</u>	<u>100</u>
Flood Control, Destination: 24-Hour Depths, Inches	3.12	3.6	4.46	5.18	6.48
Pollution Reduction: 24-Hour Depths, 1.4 Inches					

**Table C-2  
RUNOFF CURVE NUMBERS**

**Runoff curve numbers for urban areas\***

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area	A	B	C	D
		Open space (lawns, parks, golf courses, cemeteries, etc.):			
Poor condition (grass cover <50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82

**Runoff curve numbers for other agricultural lands\***

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range-continuous forage for grazing <50% ground cover or heavily grazed with no mulch 50 to 75% ground cover and not heavily grazed >75% ground cover and lightly or only occasionally grazed	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay	-	30	58	71	78
Brush--weed-grass mixture with brush as the major element <50% ground cover 50 to 75% ground cover >75% ground cover	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods-grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79

**Runoff curve numbers for other agricultural lands\***

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Woods Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning. Woods are grazed but not burned, and some forest litter covers the soil. Woods are protected from grazing, and litter and brush adequately cover the soil.	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77

**Runoff curve numbers for Simplified Approaches\*\***

Cover description		Curve numbers for hydrologic soil group			
Simplified Approaches	Hydrologic condition	A	B	C	D
Eco-roof	Good	n/a	61	n/a	n/a
Roof Garden	Good	n/a	48	n/a	n/a
Contained Planter Box	Good	n/a	48	n/a	n/a
Infiltration & Flow-Through Planter Box	Good	n/a	48	n/a	n/a
Pervious Pavement	-	76	85	89	n/a
Trees					
New and/or Existing Evergreen	-	36	60	73	79
New and/or Existing Deciduous	-	36	60	73	79

n/a - Does not apply, as design criteria for the relevant mitigation measures do not include the use of this soil type.

\*Soil Conservation Service, *Urban Hydrology for Small Watersheds*, Technical Release 55, pp. 2.5-2.8, June 1986.

\*\*CNS of various cover types were assigned to the Proposed Simplified Approaches with similar cover types as follows:

Eco-roof – assumed grass in good condition with soil type B.

Roof Garden – assumed brush-weed-grass mixture with >75% ground cover and soil type B.

Contained Planter Box – assumed brush-weed-grass mixture with >75% ground cover and soil type B.

Infiltration & Flow-Through Planter Box – assumed brush-weed-grass mixture with >75% ground cover and soil type B.

Pervious Pavement – assumed gravel.

Trees – assumed woods with fair hydrologic conditions.

**Note: To determine hydrologic soil type, consult local USDA Soil Conservation Service Soil Survey.**

**TABLE C-3**  
**NRCS HYDROLOGIC SOIL GROUP DESCRIPTIONS**

<b><u>NRCS Hydrologic Soil Group</u></b>	<b><u>Description</u></b>
Group A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.
Group B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
Group C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.
Group D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a fragipan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Figure C-1 - NRCS 24-Hour Type 1A Hyetograph

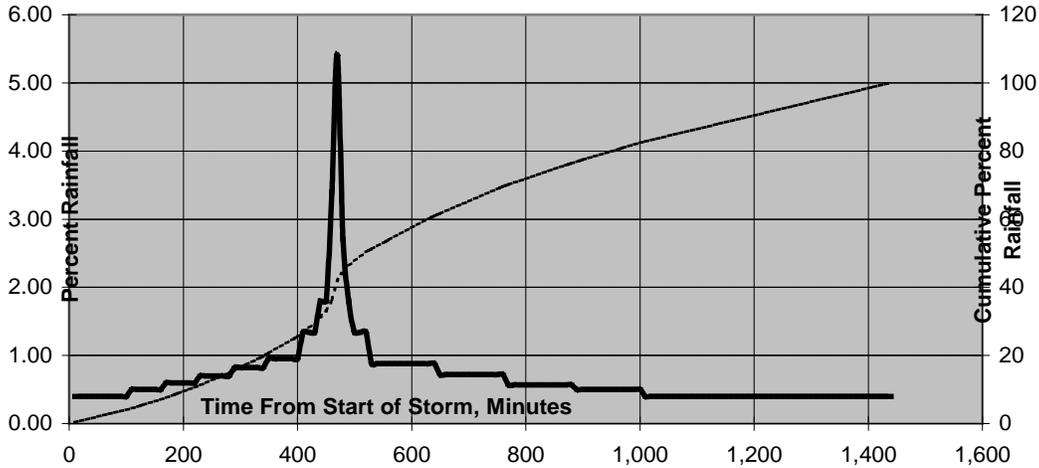


Table C-3 - NRCS Type 1A Hyetographic Distribution - For Use In Water Quality/Quantity Design

Time From Start of Storm, Minutes	Cumulative % Rainfall	Time From Start of Storm, Minutes	Cumulative % Rainfall	Time From Start of Storm, Minutes	Cumulative % Rainfall	Time From Start of Storm, Minutes	Cumulative % Rainfall
0 - 10	0.40	360 - 370	0.95	720 - 730	0.72	1080 - 1090	0.40
10 - 20	0.40	370 - 380	0.95	730 - 740	0.72	1090 - 1100	0.40
20 - 30	0.40	380 - 390	0.95	740 - 750	0.72	1100 - 1110	0.40
30 - 40	0.40	390 - 400	0.95	750 - 760	0.72	1110 - 1120	0.40
40 - 50	0.40	400 - 410	1.34	760 - 770	0.57	1120 - 1130	0.40
50 - 60	0.40	410 - 420	1.34	770 - 780	0.57	1130 - 1140	0.40
60 - 70	0.40	420 - 430	1.34	780 - 790	0.57	1140 - 1150	0.40
70 - 80	0.40	430 - 440	1.80	790 - 800	0.57	1150 - 1160	0.40
80 - 90	0.40	440 - 450	1.80	800 - 810	0.57	1160 - 1170	0.40
90 - 100	0.40	450 - 460	3.40	810 - 820	0.57	1170 - 1180	0.40
100 - 110	0.50	460 - 470	5.40	820 - 830	0.57	1180 - 1190	0.40
110 - 120	0.50	470 - 480	2.70	830 - 840	0.57	1190 - 1200	0.40
120 - 130	0.50	480 - 490	1.80	840 - 850	0.57	1200 - 1210	0.40
130 - 140	0.50	490 - 500	1.34	850 - 860	0.57	1210 - 1220	0.40
140 - 150	0.50	500 - 510	1.34	860 - 870	0.57	1220 - 1230	0.40
150 - 160	0.50	510 - 520	1.34	870 - 880	0.57	1230 - 1240	0.40
160 - 170	0.60	520 - 530	0.88	880 - 890	0.50	1240 - 1250	0.40
170 - 180	0.60	530 - 540	0.88	890 - 900	0.50	1250 - 1260	0.40
180 - 190	0.60	540 - 550	0.88	900 - 910	0.50	1260 - 1270	0.40
190 - 200	0.60	550 - 560	0.88	910 - 920	0.50	1270 - 1280	0.40
200 - 210	0.60	560 - 570	0.88	920 - 930	0.50	1280 - 1290	0.40
210 - 220	0.60	570 - 580	0.88	930 - 940	0.50	1290 - 1300	0.40
220 - 230	0.70	580 - 590	0.88	940 - 950	0.50	1300 - 1310	0.40
230 - 240	0.70	590 - 600	0.88	950 - 960	0.50	1310 - 1320	0.40
240 - 250	0.70	600 - 610	0.88	960 - 970	0.50	1320 - 1330	0.40
250 - 260	0.70	610 - 620	0.88	970 - 980	0.50	1330 - 1340	0.40
260 - 270	0.70	620 - 630	0.88	980 - 990	0.50	1340 - 1350	0.40
270 - 280	0.70	630 - 640	0.88	990 - 1000	0.50	1350 - 1360	0.40
280 - 290	0.82	640 - 650	0.72	1000 - 1010	0.40	1360 - 1370	0.40
290 - 300	0.82	650 - 660	0.72	1010 - 1020	0.40	1370 - 1380	0.40
300 - 310	0.82	660 - 670	0.72	1020 - 1030	0.40	1380 - 1390	0.40
310 - 320	0.82	670 - 680	0.72	1030 - 1040	0.40	1390 - 1400	0.40
320 - 330	0.82	680 - 690	0.72	1040 - 1050	0.40	1400 - 1410	0.40
330 - 340	0.82	690 - 700	0.72	1050 - 1060	0.40	1410 - 1420	0.40
340 - 350	0.95	700 - 710	0.72	1060 - 1070	0.40	1420 - 1430	0.40
350 - 360	0.95	710 - 720	0.72	1070 - 1080	0.40	1430 - 1440	0.40